VOLUME IX #4 JUNE 1994 PRICE $6

FOR THE DESIGN, CONSTRUCTION AND ENJOYMENT OF UNUSUAL SOUND SOURCES

EXPERIMENTAL MUSICAL INSTRUMENTS

PEOPLE , INSTRUMENTS

Christianity came to the northern part of the island of Sulawesi, Indonesia, in the first part of the 19th century. Whatever musical styles may have existed prior to that are now gone. In their place are musical styles derived primarily from European models. Yet the people's music retains a distinct flavor of its own. And the instruments ...

IN THIS ISSUE

...the instruments are especially remarkable. In recreating the brass band music of the missionaries, skilled local craftsmen developed an utterly unique orchestra of lip-buzzed instruments, first of bamboo and later of galvanized steel or tin. For the full picture, see Rob Boonzajer Flaes' article in this issue of **Experimental Musical Instruments.**

Also in this issue we have an article on Bill Colvig's new/ancient instruments, perhaps familiar to readers as the instruments central to much of the work of west coast composer Lou Harrison. Henry Lowengard presents his bizarre, irreverent, often comical computer-based sound manipulation systems. Penelope Mathiesen provides a short history of mechanical instruments, with special attention to Jacques de Vaucanson's sophisticated 18th century flute-playing automaton. Steve Ball gives us the first of two articles on home-buildable electro-magnetic pickup making for experimental instruments. Ken Lovelett describes his Bellatope, an extended percussion battery with an especially tasteful approach to the blend of natural acoustic sound with electronically processed sound. And, as always, there are reviews, notices, letters, and more. All good stuff. Open up, now, and read.

Photograph above: Standing Harp, by Bill Colvig with decroative work by Lou Harrison. See the article starting on page 16.

LETTERS

REGARDING THE IDEA of an experimental musical instrument festival: It is a great idea, and I would love to attend such an event.

For now, though I would like to invite all EMI readers to our third annual Jew's harp festival this summer. The first two attracted not only Jew's harp players but also players of such instruments as the saw, mouth bow, giant chorded zither, and didjeridu.

In fact, in our advertising this year, we are encouraging those who play "unusual or uncommon" musical instruments to attend. We expect some autoharp and mountain dulcimer, more mouthbow variations, hopefully at least one Theremin, and who knows what else.

The first two festivals were a wonderfully strange blend of the traditional and the fringe. We hope this will be an ongoing theme.

The North American Jew's Harp Festival will be held July 29-31 in Sumpter, Oregon (near Baker City). Write to P.O. Box 92, Sumpter, OR 97877 to get on the mailing list.

Gordon Frazier

MY HUSBAND AND I WONDER if you or your readers would provide more details on the instruments described in the enclosed Xerox sheets [text reproduced below].

Cozzens' description is very interesting but not complete enough for me to imagine the actual instruments or the sound. There is no original publication date on my reprinted volume but I believe the book was first printed in about 1860.

Mineko Grimmer

From the editor: The writing that Mineko Grimmer refers to is from **Explorations & Adventures in Arizona & New Mexico**, by Samuel Woodworth Cozzens, reprinted in 1988 by Castle, a division of Book Sales, Inc., Secauscus NJ. The relevant passages read:

That evening we attended vespers service in the old church, for the Papagoes still respect the religion of the Catholic Church, taught to their ancestors more than two centuries ago. I was surprised and delighted by the music; it was novel and charming.

When the priest reached a certain portion of the service, the air seemed suddenly filled by the warbling of ten thousand birds, whose melodious notes rose and fell and swelled and lingered through the arched passages of the church, now dying away as though in the far distance, and again approaching nearer and nearer, until the very air seemed resonant with the notes of the sweetest feathered songsters.

Again we heard it, but so exquisitely soft and low that its cadences more closely resembled the wailings of an Æolian harp, than music created by mortal agency. Once more it swelled into grand and lofty pæans of praise, until it seemed that such exquisite music must be created by a celestial choir. Even Jimmy, who was devoutly kneeling in prayer, stopped, and looking up, remarked, "What the divil is that now? I niver heard the likes er that, aven in ould Ireland."

As soon as we could withdraw from the service, the doctor and myself ascended to the gallery of the church, by means of a notched log of wood, that served for stairs.

Here we found, lying flat on their faces upon the floor, a dozen or more youths, before each one of whom stood a small cup of water, in which was inserted one end of split reeds of different sizes, the other end of the reed being held in their mouths, and blowing through it, they produced the sweet sounds which had so enchanted us.

THE EDITOR'S REPORT IN THE DEC '93 ISSUE caused at least one eyebrow to raise. EMI getting into conventional instruments? It seems like just about every "conventional" instrument has a fair number of books and periodicals already devoted to it. But what about experimental aspects of these instruments?

For instance, what is the reasoning behind – and the measurable results of – different bracing systems and soundhole(s) placement in the construction of acoustic guitars? Also, although the action mechanisms for grand and upright pianos are different and have changed little in over a hundred years, there is now a company making upright pianos whose action is said to have the nuances of a grand. What's the story?

In any case, it seems like the essence of EMI lies in its active interest in listening to somebody with an instrument or a piece of junk who had the curiosity to think "Hey, what if..." I would hate to see that be lost.

Thanks for Bill Sethares' very interesting and illuminating article on timbre and tuning. I also was fascinated by Blake Michell's Equimarimbas (Vol. IX#1) and am looking forward to the publication of his book. Recently I've become intrigued by the two-tone capabilities of certain marimba bars.

If a bar is not too short and preferably less than twice as

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wide as it is thick, it is capable of producing *two* distinct fundamental tones. The second tone is the side tone" which is produced by hitting the side of the bar, and tuned by narrowing the middle portion of the bar. This tone can easily be tuned independently of the top fundamental tone because it is vibrating in a different plane. So far I've made a wind chime consisting of five of these tuned two-tone bars. In the longest bars about 2 feet the first harmonic of the top tone is also quite audible, so the 5-bar assembly produces an uncanny array of twelve separate tones whose combinations vary with the wind.

In an unrelated vein, another development in the marine trumpet (lightly regarded "conventional" instrument of 17th-18th centuries): I made a sitar-type bridge for the sympathetic strings which has enriched the tone substantially, and since the tone quality of the instrument is brassy to begin with, the buzz caused by the new bridge blends right in.

Speaking of buzzes, a number of years ago I was looking for a boat horn-blast sound for a theatrical production, and ultimately found a solution in the addition of a mirliton membrane to a plastic pipe didjeridu. A hole approximately 1" in diameter was drilled in the 1 ½ " pipe about 3"-4" from the mouthpiece, and a thin plastic wrap was then taped over the hole. The resulting blast was pretty convincing, and the membrane lasted just about as long as the run of the show. Coincidence?

Michael Meadows

I'VE BEEN CO-HOSTING and producing a weekly radio program on CFUV radio here in Victoria for nine years now. We feature a wide variety of experimental and unusual music and have had an on-going series devoted to presenting recordings of experimental musical instruments and information on their creators. If any of your readers would like to send us any recordings and/or background information on their work, we'd be happy to hear from them. We also encourage anyone with the interest and facilities to host and pre-produce their own program on cassette for us to air. Write us and we'll send you more specific details. Programs in the works include profiles on Hans Reichel, Uakti, and Joe Jones. I would really love to do a feature on the Baschet brothers, but don't have enough recordings of their sculptures to do them justice. Maybe one of your readers would like to try and take this one on or help contribute some material?

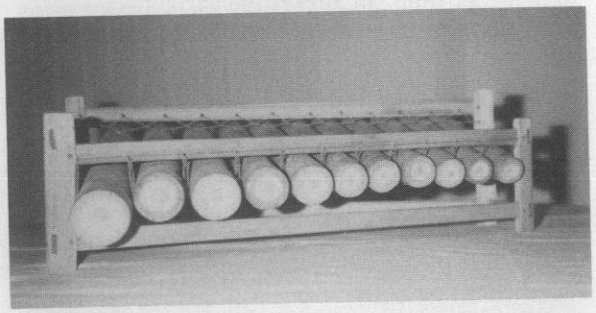
Brian Lunger
V.C.P.O. Box 8068, Victoria, B.C., Canada, V8W 3R7

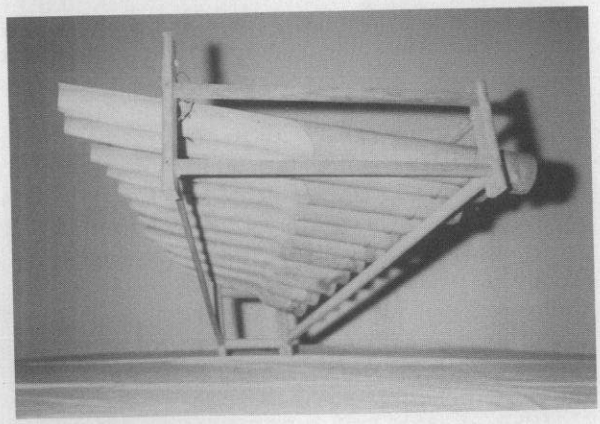
YOUR RECENT ARTICLE on the *angklung* I found interesting as I have been messing around with the tuning peculiarities of the bamboo marimba. The tubes are identically tuned to the angklung but instead of being excited by an internal rattle they're struck with mallets (or is that smitten?). The individual bars are suspended with cords down from a framework. I own a cheap tourist model from Indonesia consisting of eleven bars ranging from about eight inches to about twenty inches. I looked at one once advertised in the L.A. newspaper (wished I'd bought it) that this guy had picked up in Bali. On a beautifully carved but traditionally too heavily lacquered stand were suspended eleven bars ranging in length from perhaps sixteen to forty inches. The bamboo used in both instruments is fairly thin walled with long distances between nodes. The beauty and attraction of these instruments to me lies in their sound, (probably not a bad attribute for a musical instrument). Different from any other marimba, these have a dry, hollow, almost spooky sound.

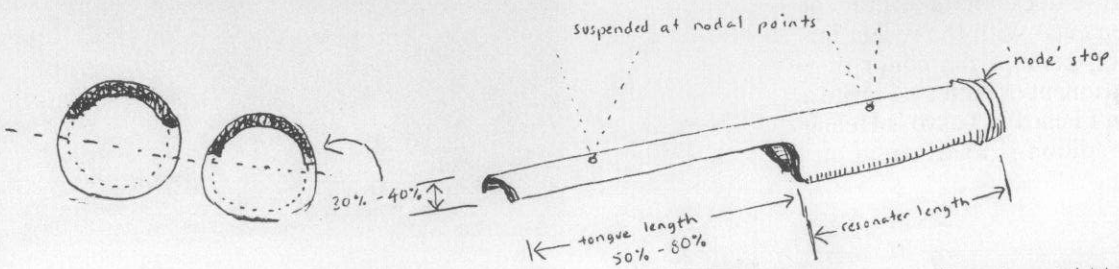
Having plenty of free bamboo here to mess around with (one of the few things cheaper in Hawaii) I've done some experimenting with making some bars, and you're right, it's a little tricky to get the bars tuned and to get an incorporated resonator sympathetically tuned to the bar, without losing the tonal quality. [The writer is referring to the discussion of this topic on pages 14-15 of EMI's Dec'93 issue.] On the model I have for comparison the cut away tongue is roughly 30%-40% of the original bamboo in diameter, and ranges from 50%-80% in length with the higher notes having more tongue and less tube. The resonator lengths (not surprisingly) are very similar to a "western" marimba [see drawings below].

And concerning your annual report...

Personally I'm all for EMI presenting more information on traditional instruments. This is why in the first place I started reading and subscribing to the magazine. Over the course of the years I've learned a lot and have become aware and intrigued with a variety of sound and frequency producing

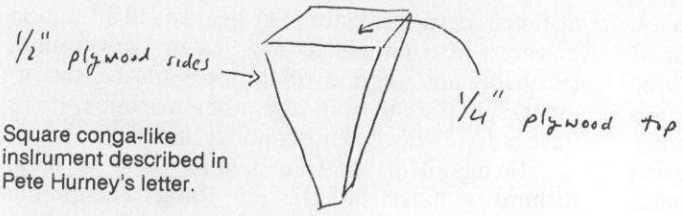






Photos above: Indonesian bamboo bars described by Pete Hurney. The lower photo shows the underside, revealing the cutaway portion of the bamboo,

Drawing at left: Typical dimensions for the cutaway bamboo.



Square conga-like instrument described in Pete Hurney's letter.

devices that I wouldn't of otherwise been exposed to. Some, I've even gone as far as building, but most of them don't fit into the realm of music I perform in (R&R) and/or cannot fit into my vehicle (moderate size restrictions) and/or are not suitable-feasible to make and sell.

Definite absence of letters replying to your editorial, or are they all to appear in the next issue?

I saw in a store in L.A. recently (went there for the earthquake) a variation of a Conga [shown in the drawing on the preceding page] which was interesting so I came home and made one now I'm making a variation of, doing some experimenting on the idea which is a plywood box in a tapered square (is that a trapezoid or a rhomboid?) [see drawing above] and it sounds pretty darn good too. I think its length has something to be desired (only 18") and my experiment will be 6 sided; we'll see how nasty that is to try to piece together as the square shape is awkward, sharp edged and probably not acoustically desirable (although I've seen square frame drums, Irish, I think). The square top also gives a funny playing surface when one is used to a conga but, all in all, it's quite an interesting variant.

Waiting to hear yours and others views in response to editorial.

Pete Hurney

I ONCE HEARD a performance of the Dàn bâu, single-string box zither of Vietnam. The delicate nuances and broad range made possible by a hand-operated lever to continually vary the tension of the string is unmatched by any traditional single-string instrument I know of. *Grove's Dictionary of Musical Instruments* gives it a column; generous for a relatively unknown instrument, perhaps, but woefully inadequate considering the Dàn bâu's uniqueness and its potential for Western and world music. The author of the entry, Trân Quang Hai, claims that with the use of an amplifier, "the instrument loses its intimate subtlety and mysterious character and only produces artificial sounds similar to those of the Hawaiian guitar." This is not true. The sound is far more eerie and ephemeral thanks to the tension-varying lever, it cannot help but be so. While it is characterized by "an exclusive use of harmonics," my impression of the amplified performance was that it could play just about anything. I could swear I saw jealousy in the eyes of a good portion of the awed orchestra.

While the Dàn bâu is not "experimental" in Vietnam, it is to those of us with little experience with it. I hope for a full introduction, including what Grove does not: a diagram of the lever-gourd-pickup arrangement. With the recent improvement in Vietnam–US ties, perhaps the editor or a reader could import such an instrument or better yet invite a Dàn bâu musician. The musician I heard in Tokyo is Hoang Anh Tú. He is heir to a family tradition – reads music, etc.

Robin Gill

GOOD NEWS!! I am purchasing this very unique building down the road from my house. I expect to open a gallery, specifically, to show my pieces as well as pieces submitted by your readers and participants. So if anyone is interested, please submit literature, photos and tapes of the pieces to be juried.

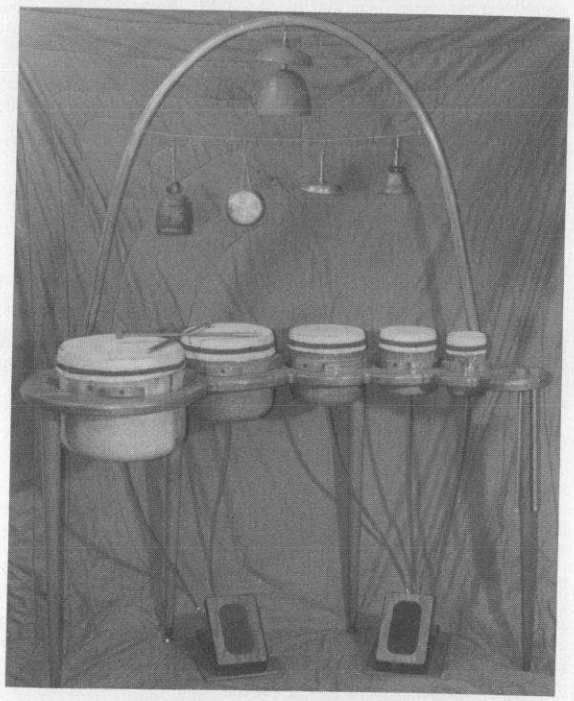
I am also on the last leg of completing a digital and analog recording studio. I hope this studio will someday be a tool to help promote experimental musical instruments.

The photo shows my nagarra drums. They are a hybrid cross between the modern timpani and the naggara drums of old. Our present day timpani can be traced back to tiny clay drums about the size of our bongos called naggara. The naggara were played in pairs. Returning crusaders introduced these drums into Europe. By the end of the thirteenth century small kettledrums appeared. In England they were known as *nakers* and in France, *nacaires*. The bowl-shaped nakers varied in diameter between 20 and 30 cm. Naturally, they had one head and the bowls were made of leather, wood, and copper as well as clay. They were played suspended from a waist or shoulder strap, although occasionally they were placed upon the ground. Nakers gradually disappeared from use during the fifteenth century and were replaced with the larger Turkish-oriented timpani.

My nagarra drums are made of clay or wood and are small like the original naggara drums. There are, however, five drums instead of two which gives a wider tonal variance and they are arranged with the larger drum to the left of the performer. They are also set in a wooden table to create ease of playing. Two foot-operated bellows with tubes going into each drum create the ability to change pitch for an effect like a glissando and offering many exciting new possibilities for rhythmic and tonal nuances. The arc that rides over the top of the naggara drums is to hold bells, chimes, or a multitude of other objects chosen by the performers. This also creates many new timbral possibilities. Lastly, the drums have four mallets instead of just two and can be played with the hands as well.

This completely handmade instrument has taken several years to develop and build. There will only be a limited number made. They are patented, and are sold through Protocussion. A tape of this instrument will also be available. Just call or write.

Ken Lovelett
P.O. Box 65, Mt. Tremper, NY 12457.



Naggara drums made by Ken Lovelett of Protocussion.

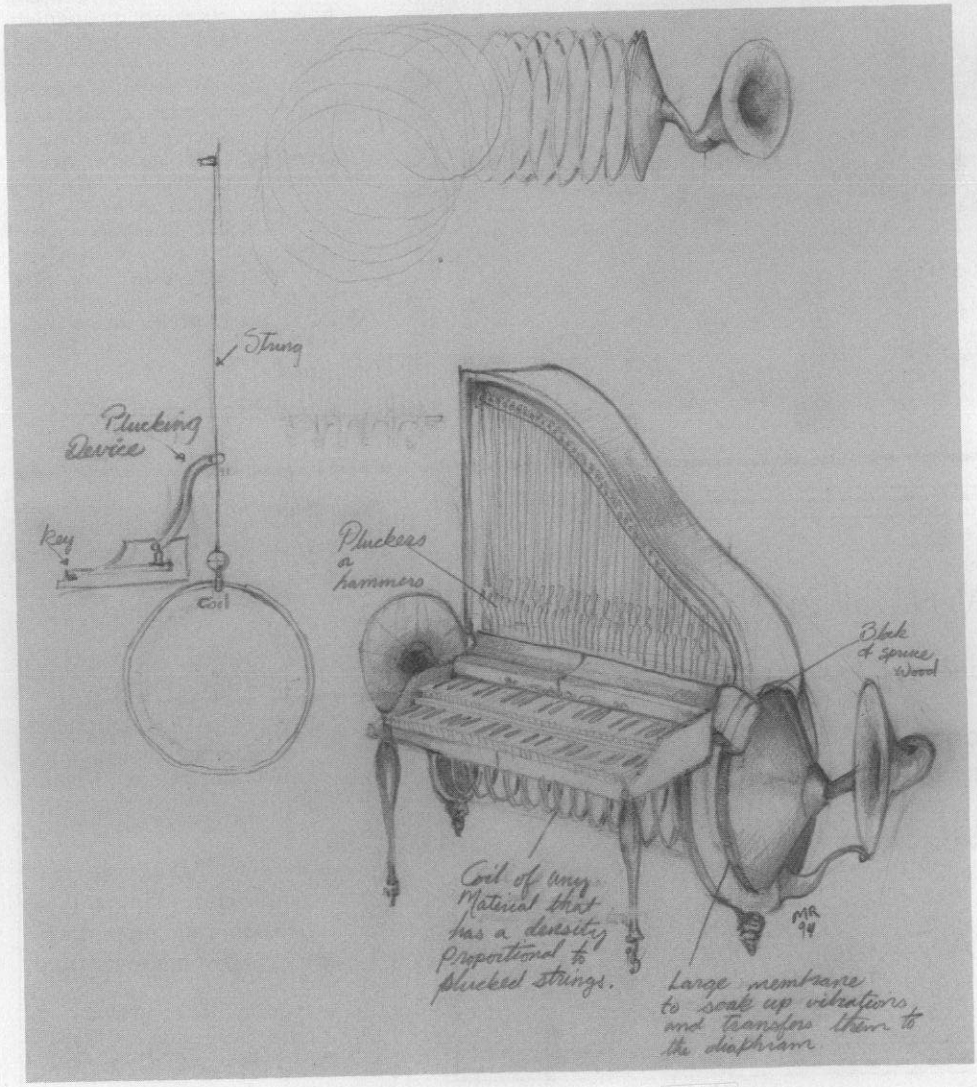
MY NAME IS MATTHEW REYNOLDS. I am 18 years old and live about 30 miles outside of the city of Houston. Recently I was introduced to your magazine by my instructor of the tabla drums. I am thoroughly impressed! It has been a few years that we've been itching to see something this cool in magazines. The article in the Dec. '93 addition written by Q.R. Ghazala caught my attention and took me back into a scientific realm that seemed to very seldom go through people's minds. Many seem frightened of these infinite Catacombs of science. Venturing through such realms is a hobby to be enlightened with, me thinks. I write to you to show what exploration in sound chambers I've done, in reply to the article on the Sound Dungeon by Q.R. Ghazala.

In my design a coil of metal is the Sound Chamber. This coil is fed by about a four-octave arrangement of nylon, or metal strings. These are bridged to the coil by means of a rod of wood, a type of wood, like spruce, that would make the vibrations travel into the sound chamber without any unwanted high pitches or messy overtones. The messy overtones would probably become one within the rod and be transferred as a sort of drone behind the music. All is set into motion by plucking devices activated by keys. A doctor's stethoscope doesn't only bridge the vibratory realm of the human body to our ears but also opens many other inaudible activities as in the sound chambers. For my design I replaced transducer microphone equipment with a membrane diaphragm and horn (an enlarged stethoscope). The membrane reaches across the whole diameter of the coil of the sound chamber. Since the amount of vibrations traveling into the diaphragm is at such a large amount proportionally, they could be opened to our plane by means of a horn. This system seems more thought provoking towards the inner nature of the instrument. In enlarging the sound chamber it would make it easier for the experimenter to shape and manipulate the music produced. Influential forces could be easily applied. What if the coil was hollow and a liquid substance was placed within its cavity and had the ability to be pushed and pulled, what an interesting effect this would perform on the sounds!

Ashamed I am to say that this design was only conceived and not built yet. I do hope that it is of your interest towards the realm of sound chambers. I am sincerely looking forward to receiving more of your wonderful magazines in the future.

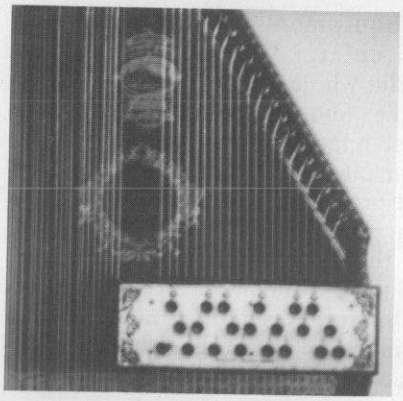
Matthew Reynolds

Closet-chest of Echos — an instrument waiting to be built by Mathew Reynolds



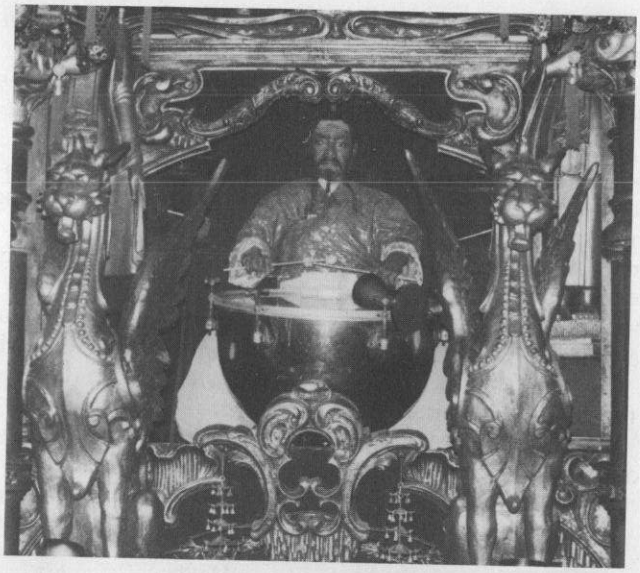
PAGE 32 OF THE MARCH '94 ISSUE of EMI bears a picture of a "Mando-Zither-Harp". I just found a similar item at an antique store [photo next page]. The outside of mine bears a decal stating "American Mandolin Harp, Special, Jamestown Model" with an illustration of a building marked "Palace of varied industries". Inside the soundhole is a sticker that states "American Mandolin Harp, Style-B, manufactured by Oscar Schmidt, Jersey City" and lists several patents between 5/29/84 through 6/5/00. The button plate is roller mounted so it has an inch of movement perpendicular to the strings. Each button is attached to a short, thick needle. When buttons are depressed and the plate is rapidly wiggled, it gives a sound similar to a mandolin being strummed repeatedly. In the separate chordal groups of strings left of the soundhole, the first group is e-a-c#-A, with the 4th string an octave lower.

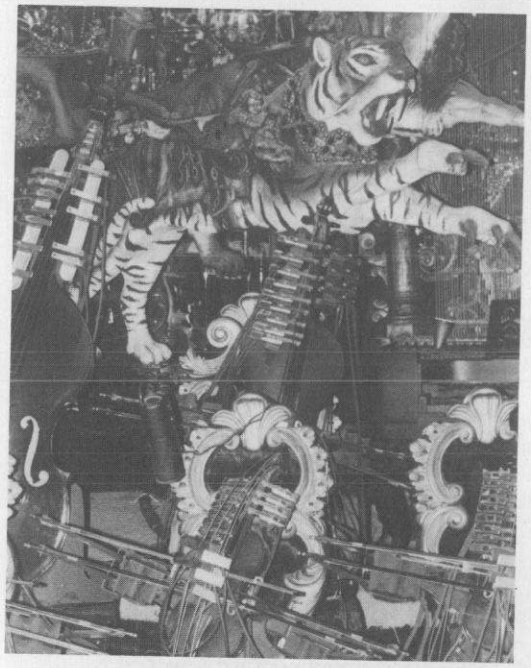
Page 6 mentioned House On The Rock. I was there 5 years ago and still remember it vividly. I walked through the dark caverns built into the side of a hill and came upon The Blue Room and The Red Room. In a lavishly decorated room were a bunch of chairs, upon each sitting an orchestral instrument, but no musicians to be found. There were complicated yet primitive looking mechanical contraptions attached to each and many hoses all over. There I was, alone in this dark cave staring at this strange display, not knowing what it was. I saw an unmarked coin slot, and although I did not know if it was okay to do so, I popped in a quarter. First I heard a loud hissing noise and the sound of motors; what had I done, I asked myself. Then the faint sound of a violin playing itself. Then more instruments until it built to a pretty loud

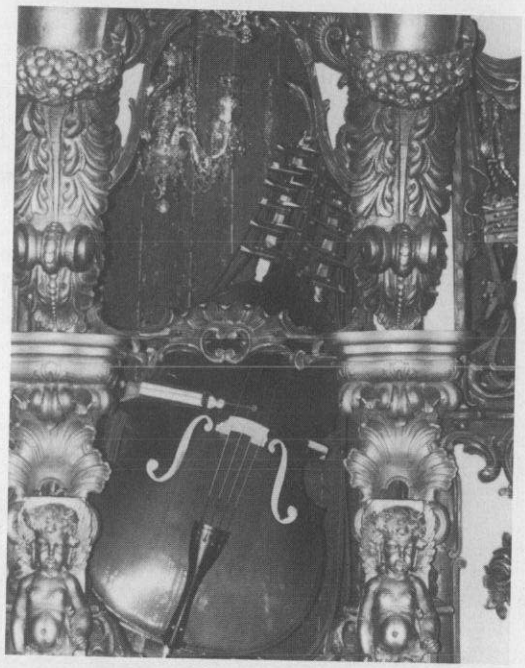


Above: American Mandolin Harp.

Right and below: automatons and mechanically played instruments at House on the Rock, Spring Green, Wisconsin.







and convincing orchestra. Then the music abruptly stopped, leaving just the hissing sound, like a punctured tire losing air. I had seen simple automatons before but never anything like this. It was stunning. If that wasn't enough, in another room known as The Mikado, rather than the instruments playing themselves, life-size animated figures play them. The horn player's cheeks move as he blows. The figures' eyes seem to follow me and they make strange faces. It's eerie but great. I can't wait to go again.

Art Finigan

From the editor: Indeed, the American Mandolin Harp in Art Finigan's photo (below) is essentially identical to the instrument sold by Mussehl & Westphal as a Mando-Zither-Harp, shown in the Mussehl & Westphal article in EMI's last issue. Thanks to Art for clarifying how the plucking mechanism works. The Oscar Schmidt company, who made the American Mandolin Harp, is best known as the leading manufacturer of autoharps. They appear to have had licensing agreements allowing other retailers to sell similar zither-like inventions (a similar situation came up in EMI's recent article on the Marx musical instrument company as well), and so it seems that the Mussehl & Westphal people were selling the Oscar Schmidt instrument under another name.

IVOR DARREG, 1917—1994

EMI's readers will be saddened to learn that the microtonal theorist, innovative instrument maker and thinker/correspondent Ivor Darreg died on February 12th. Ivor's writings often appeared in these pages, in articles and in voluminous letters-to-the-editor, and he was an important influence on many others who have been part of EMI's world family. The following writings are from people who knew him well, starting with a brief biography from Jonathan Glasier.

Biography

Ivor Darreg was born Kenneth Vincent Gerard O'Hara, in Portland Oregon. His father John was editor of a weekly Catholic newspaper and his mother was an artist. Ivor dropped out of school as a teenager because he had a series of illnesses which left him without teeth and with very little energy. He did have energy to learn. He was self taught in at least ten languages which he read and spoke. He had a basic understanding of all the sciences. His real love was music and electronics. Because of his choice of music, his father cast him out and he and his mother set out on their own with little help from anyone. At that point he took on the name "Ivor" which means "man with bow" (from his cello playing talents) and "Drareg" (the retrograde inversion of "Gerard"), soon changed to "Darreg"

Ivor's life with his mother was a huge struggle. Ivor's health was poor until his mother died in 1972. Part of the reason was that they lived on canned soup, and the salt kept his blood pressure sky high. Because of being poor in health and in wealth, Ivor became resourceful. He picked up stray wires which were cut off from telephone poles and other things on the street and from friends. He said he learned to "squeeze a penny so hard, it would say ouch."

Ivor created his first instrument, the Electronic Keyboard Oboe, in 1937. Following the current history of electronics, reading from the journals of the day he learned circuitry. He made the instrument, which still runs today, because the orchestra he was playing in needed an oboe and Ivor took the challenge. The Electronic Keyboard Oboe is not only one of the first synthesizers, but a microtonal one at that. It plays the regular twelve tones, but there are eight buttons which move the tone in gradation from a few cents for a tremolo effect to a full quarter tone.

In the forties, Ivor built the Amplified Cello, Amplified Clavichord and the Electric Keyboard Drum. The Amplified Clavichord no longer exists, but the Electric Keyboard Drum, which uses the old buzzer-like relays, and the Amplified Cello are still working.

In the fifties Ivor created an organ with elastic tuning. The circuitry would justify thirds and fifths. We have recordings of this instrument. In fact, we have all 260 reel to reel, and 464 cassette recordings that belonged to Ivor. As caretakers of Ivor's estate, my wife, Elizabeth, and I also have 72 of his instruments, some which were on loan and will be returned, as well as Ivor's papers which include five four-drawer file cabinets full of his writings and subject file. It will be a while before the papers will be categorized, and it is unclear at this point where the final resting place will be. Hopefully someplace where people can use it.

In the early sixties, Ivor met Ervin Wilson and Harry Partch. Upon conversing with and seeing Wilson's refretted guitars and metal tubulongs (3/4" electric conduit), Ivor took the plunge into microtonality or Xenharmony. He began refretting guitars and making tubulongs and metallophones in 10, 14, 15, 16, 17, 19, 21, 22, 24, 31, and 34 tone temperaments. He shared this new beginning with others through his *Xenharmonic Bulletin* and other writings. The Xenharmonic Alliance [a network of people interested in alternative tuning systems] was created. When we met Ivor in 1977, through John Chalmers, I saw a need to give Ivor and others a more public forum, so I started the journal *Interval/ Journal of Music Research and Development*. Then in 1981, Johnny Reinhard created the American Microtonal Festival in New York, and in 1984 the *1/1* just intonation group started in San Francisco. Recently the South East Just Intonation Center has been created by Denny Genovese.

In the seventies, Ivor created his Megalyra family of instruments, the Megalyra itself being the tour de force of Ivor instrumental creations (featured in EMI Vol. II #2). This six to eight foot long contra bass slide guitar is strung on both sides to solo (I-I-V-I) and bass (I-V-I) configurations. This instrument sounds like tuned thunder and is waiting for some heavy metaler or slide guitar pro to make it a celebrity. Other instruments in the Megalyra family are the Drone, Kosmolyra, and the Hobnailed Newel Post, which is 6" by 6" beam strung with over seventy strings. Ivor called this instrument an harmonic laboratory.

Those of you who knew Ivor or read his writing in EMI knew that he had a special outlook on music, and a comprehensive mind which explored many subjects. His compositions, of which all are either on tape or written down, date from 1935. Many of his piano compositions are available on cassette, played by Ivor, and a selection of his Xenharmonic Frontier tapes, recorded and edited by Brian McLaren, will be available on CD this summer through the Ivor Darreg Memorial Fund. To be published later in the year is the *Complete Musical Writings of Ivor Darreg* a three hundred page tome, also available from the fund [see "Projects Related ..." below for full information].

Elizabeth and I brought Ivor to San Diego in 1985, and he seemed to get younger every year. He was in the best health of his life for those years and we were very happy to be there to share time with this great man and friend, and see him spend the most productive and stable years of his life here in San Diego. We miss you Ivor.

Jonathan Glasier

Editor's note: Jonathan and Elizabeth Glasier can be credited with having seen to it that Ivor was able to live and work productively through his later years, by assuring him a place to live and supporting his work in innumerable other ways.

In Memoriam: Ivor Darreg

As many may have already heard, the composer, performer, theorist, instrument builder, author, linguist, lecturer, and prolific correspondent Ivor Darreg died Saturday, February 12th, 1994 at Mercy Hospital in San Diego, California. Ivor became sick suddenly in early December with gall stones and pancreatitis, and later in the hospital he developed kidney and liver failure following surgery for an abdominal infection. He was 76 years old and was in good health up to the day he fell ill. Happily, a number of his long-time friends and musical col-

leagues were in San Diego in late 1993 and were able to visit him while he was still well.

In recent years Ivor had become virtually a regular columnist in EMI where excerpts from his extensive correspondence and his collection of articles on early electrical and electronic instruments appeared in almost every issue. Ironically, his last column in the December 1993 issue voiced his concerns that his accomplishments would be lost and forgotten after his death. I am happy to report that efforts were made during his illness to prevent this from happening. Jonathan and Elizabeth Glasier have set up a memorial fund so that a CD of Ivor's cycle of MIDI improvisations in all of the equally tempered tunings with five to 53 (except 12!) tones per octave may be issued [see full information below under "Projects Related ..."]. This collection, entitled *All Systems Go*, was edited, orchestrated, and recorded in collaboration with Brian McLaren.

For the last several years, Brian McLaren has been entering Ivor's voluminous writings on music into his computer so that he might edit them for publication as a book. Brian has also copied Ivor's extensive collection of microtonal music, both of his own compositions and those of other composers and in digital format (DAT) so that this unique sound archive will not become lost. Fortunately, audio and video recordings were also made of Ivor's recent lectures and performances. These recordings show him playing some of the novel instruments he has designed and constructed for the performance of *xenharmonic* music, a term Ivor coined to describe music not in the traditional 12-tone equal tuning.

Ivor's "orchestra" of refretted acoustic and electric guitars, electrified stringed instruments (Megalyra, etc.), and tuned bar or tube percussion instruments is being preserved by the Glasiers. Plans are being considered to turn Ivor's house into a center for xenharmonic music and to make the instruments available to composers and performers visiting or resident in the San Diego area.

On March 6th the Glasiers hosted a memorial gathering for Ivor at their home. People who knew Ivor well or had been influenced by his writings and recordings came from as far away as Texas to pay tribute to him. It was decided that the *Xenharmonic Alliance,* the informal network of musical experimenters that Ivor had collected and connected by his correspondence, should be maintained. Gary Morrison has volunteered to take on this task [full information below].

I might add that outside of music, Darreg's major work was the Numaudo Code, a system he invented in the late 1950s for vocalizing mathematical and symbolic logic notation.

John Chalmers

AS YOU HAVE MOST LIKELY HEARD, Ivor Darreg recently died of acute pancreatitis and the complications thereof. As with so many of us, Ivor was very important to me. What he meant to each of us is undoubtedly as individual as each of our experiences with him. To me, he was perhaps best characterized as a "personal creative mentor". Having the disadvantage of living half a country away, I did not get to enjoy as much direct physical interaction with him as many did. I'm sure that those who had that experience will miss his physical presence.

Before I go on, many at the Glasiers' recent memorial were concerned that Ivor's friends would worry about the fate of Ivor's legacy. Well, let me assure you that Ivor's legacy appears to be in good hands. I say "appears to be" because his legacy has many aspects. Some of those aspects, such as his instruments, compositions, performances, and his writings, are in the best of hands we could possibly hope for, thanks to the Glasiers, Brian McLaren and others. They will tell you more about that in the near future.

Some other aspects of his legacy, however, are in all of our hands, and preserving these aspects will be up to all of us to accomplish on a day-by day, year-to year basis. There will be no single triumph to signal ultimate success. One such aspect was that he glued together will over a hundred microtonalists, just intonationalists, and experimental instrument builders throughout the world. He called us the *Xenharmonic Alliance*. Not to downplay the importance of his performances, compositions, or theoretical studies of course, but I feel that that was one of his most valuable, yet easily overlooked, contributions. We must combine our creative talents, in harmony (ug!), if we are to break out of this 19-century twelve-equal rut. And even all quests aside, isn't it more fun working together anyway?

While I can't fill Ivor's shoes any more than I can bring him back to us, I would like to humbly ask of you the honor of carrying on that Ivorian tradition. Ivor certainly didn't hand-pick me to fill such a role, so I hope that my efforts will earn your trust, acceptance, and assistance in this regard. I won't be able to provide as much insightful wisdom, or the full-time effort, the guru could. Still .... [Gary's letter goes on here to discuss plans for the continuation of the Xenharmonic Alliance. See the contact information listed below under "Projects Relating ..." for full information.]

Gary Morrison

EIGHT DAYS BEFORE IVOR DARREG FELL ILL I received one of his letters. On re-reading it yesterday, the following passage fairly leapt off the page:

These piano-ensemble things were part of the background that inclined me to study timbre and then put a bee in my bonnet about *What If* we could play all the instruments of an orchestra from keyboards, and of course that dream has come true.

But my entire life-story has been one person after another trying to dissuade me from every thought I ever put up.

Maybe some day you can write The Decline And Fall of the Pianofortic Empire. Meanwhile, look how skewed Carillo's thinking was because of the domination of the piano throughout his life. During most of my lifetime, of course, the economic forces holding the piano in place seemed as immutable as the rocks and valleys of our fair land, but today with younger generations and portable keyboards those same economic forces are now on *our* side forcing changes. There is some hope. It's not so much whether that new Yamaha synthesizer is locked into 12; it is rather that recording and playback machines are not. The Hammond Organ WAS locked into 12 by its gearing and its Synchronous Motor. The Novachord could have been modified to permit bending, and then newer keyboards sported bending levers. If the makers had determined to lock to 12 *forever*, that bending lever and the design changes that permitted its installation could have been suppressed about 1946 but by then the cat was out of the bag.

Ivor Darreg, letter dated 15 November 1993.

Ivor was one of the most remarkable minds I have encountered. His knowledge of music, phonetics, electronics, acoustics and instrument-building was extraordinary. Autodidact deluxe also one hell of an inspiration. Here was a guy who had, literally, nothing. Parts from junked TV sets. Some carpenter's tools. Actions from old beat-up pianos.

You or I would have thrown up our hands. What can you do with *nothing*?

What Ivor did was to build an 8-foot-long magnetically amplified clavichord out of the tack piano parts. From the thrown-away TV sets he built an Elastic Tuning Organ. Then he proceeded to retune it into every scale from 12 through 24 tones per octave and record music in a whole gamut of different equal temperaments.

Ivor Darreg's life was a case study in what you can do with nothing provided you've got genius.

His writings are nearly all on computer disk now. The range is amazing. It'll take some time to put the musical diagrams and examples into the text but once that's done *The Complete Musical Writings of Ivor Darreg* will be available to everyone.

Yes, Ivor was a wonderful friend. Yes, we will all miss him terribly. But – as he pointed out in his Xenharmonic Bulletin No. 5, written in 1975 – "*It will take the co-operation of many persons for quite some time to come to map out the vastness of xenharmonic territory.*"

We should celebrate his life – and push forward. Ivor gave us a glimpse of the infinite range of new sonorities available by breaking free of "the twelve-tone squirrel-cage," as he called it. The best memorial we can offer is to continue exploring the possible musics "beyond the xenharmonic frontier."

B. McLaren

PROJECTS RELATING TO IVOR'S LEGACY

Jonathan and Elizabeth Glasier have established the Ivor Darreg Memorial Fund. Proceeds are being used to publish a CD of Ivor's music mentioned by the writers above, and the set of collected writings to be titled **The Complete Musical Writings of Ivor Darreg**. In addition, his complete recordings (a vast collection of cassettes and reel-to-reel tapes) are being transferred to DAT and archived. These materials, which are expected to be available by Summer 1994, will be available through the Ivor Darreg Memorial Fund ($12 for the CD; about $25 expected price for the collected writings). Contributions to the fund are welcome as well. Write to **Ivor Darreg Memorial Fund, c/o Jonathan Glasier, PO Box 371443, San Diego CA 92137-1443, USA.**

In addition, Ivor's Xenharmonic Alliance, facilitating communication between microtonalists, will continue to operate under the auspices of Gary Morrison. For more information or to become part of this network, contact Gary at 13036 Station Drive, Austin, TX, 78727-4513, phone (512) 832-0133. He will send a questionnaire, along with other information, as he is seeking input from interested individuals as to the directions the alliance should take from here.

NOTES FROM HERE AND THERE

UTANDANDE, the newsletter devoted to "connecting the marimba and mbira music community," will be changing its name to *Dandemutande,* which reflects more accurately the newsletter's purposes in Shona usage. Whatever the name, the newsletter has continued to grow as an excellent resource for anyone interested in mbira and marimba. Next issue will feature this challenging forum topic: Ethics and World Music. (1711 E Spruce St., Seattle WA 98122-5728)

MIKE HOVANCSEK, in a letter appearing in EMI's last issue, briefly described the work of the composer P.W. Schreck. Among his diverse compositions were works using piano wires with tape recorder heads, as well as appropriated wire recordings (early electromagnetic recording medium). Readers may be interested to learn that a cassette of Schreck's music (for conventional instruments, in this case), produced by Annie Gosfield, is available for $12 from the producer at 301 East 12 St. #3D, New York City NY 10003. An interview with Schreck appears in the current volume of The Improvisor see the "Recent Articles" at the back of this issue of EMI for details.

ISSUES RAISED a couple of issues ago: In the editor's report appearing in EMI's December 1993 edition there was some speculation about whether it would be appropriate for EMI to broaden its scope to include more practical information on home-buildable conventional instruments, as opposed to the current nominal emphasis on experimental instrument types. As can be seen from letters appearing elsewhere in this issue, there have been opinions on both sides. But the response has been moderate and not especially heated. As editor, I take this to suggest that current editorial directions are acceptable to most people. This means that EMI will continue its fascination with the unusual and esoteric, at the same time remaining open to a somewhat broader range of instrument types, some of which aren't so very experimental.

Then, in the "Notes From...." section of the following issue, I raised the question – just out of curiosity, mind you – of whether many people would support something like a convention of experimental instrument makers. More importantly (I asked), is it likely that one or more people would volunteer to do the considerable work involved in organizing such a gathering? Judging from people's comments to date, it's clear that plenty of people like the idea of a convention, but it is not clear how many people would actually break their daily routine and shell out a few dollars in order to attend. And so, until someone steps forward with a good deal of energy to devote to the project, the idea will remain a maybe-someday kind of thing.

ALSO IN EMI'S LAST ISSUE, I (the editor) made note of the fact that a discussion group for musical instrument makers has appeared on the Internet computer network. I did not give full information as to how to gain access to the discussion group because up to press time I had not been able to get that information. Now, many weeks and several inquiries from interested readers later, I have to report that despite repeated effort I still have been unable to track down that information. I know that the group did indeed exist because I have seen a print-out of a large number of the postings.

HOWEVER, I have since gotten word of some other computer forums of potential interest, and I have more complete information on them thanks to John Chalmers. (1) A mailing list devoted to alternative tuning systems has appeared under the auspices of Greg Higgs at Mills College. To subscribe send the one-line message *Subscribe tuning [your name]* to this E-Mail address: *Listproc@Varese.Mills.Edu*. You will soon start receiving messages sent to those on the list by other subscribers. (2) On the Usenet network, often available through Internet, there is a "newsgroup" (similar in function to the mailing lists described above) for instrument builders at the Usenet address *Rec.Music.Makers.Builders.* (3) The CompuServe Information Service will offer a month-long focus in instrument making in the Focus section of the Crafts Forum. See the notice in this issue's Notices section for complete information.

BAMBOO BRASS IN THE MINAHASSA

by Robert Boonzajer Flaes

The following article was written by the Dutch anthropologist Robert Boonzajer Flaes and appeared first in the Swiss magazine **Brass Bulletin**, *who kindly granted permission to reprint it. The author rewrote this text with the interests of EMI's readership in mind. I met Boonzajer Flaes for an interview about his Frozen Brass-project: in 1993 years of research into brass music all over the world culminated in a book, two CDs (and hopefully more to come), a film, exhibitions and a short tour of three bands through the Netherlands and Belgium. His work shows how the concept of brass instruments and percussion (paragon of religious and military power) was sown in colonial states, struck root and started to blossom in exotic abundance, being adapted by the cultures that fostered it. In "Bamboo Brass in the Minahassa" Boonzajer Flaes describes why and how people from the northern part of the island of Sulawesi invented an entirely new set of instruments. He puts music and instruments in the perspective of their society and culture. The article is an abridged and adapted version of a chapter from his book* **Bewogen Koper**.

Since I became acquainted with **Experimental Musical Instruments** *I have always found that ethnic traditions of instrument building and usage is a topic that falls within the scope of the magazine. I find it particularly gratifying that I can present an article dealing with various themes within the topic and at the same time providing entertaining evidence why the field as a whole is worth exploring.*

— René van Peer

The people from the Minahassa (the northern part of the island of Sulawesi, in Indonesia) had been known for their musical talents since the Dutch first set foot there in the 1650s. In contrast with the main island of Java, the Dutch were seen as a worthy ally against other invaders, and as a welcome source of political stability. The Dutch developed a close relationship with the ruling Minahassa elite as trading partners at first, and later on as a cultural example. This is why the Minahassans were trusted to form the backbone of the Dutch colonial army, instrumental in suppressing the Aceh rebellion in Sumatra just after the turn of this century.

When Dutch missionaries started christianizing the population in the 1830s, they capitalized on both the political and cultural loyalty of the Minahassans, and on their musical skills. They adapted the local pentatonic *suling* (a simple bamboo flute mainly used in rural folk music) to their needs. By adding two extra holes they changed the instrument into the diatonic *floit* (named after the Dutch fluit, the English flute), and used this instrument as a device to teach Christian songs to the Minahassans. These simple instruments not only brought the diatonic tone scale to the Minahassa, but led to a complete collapse of the indigenous music. Not a single traditional Minahassan song remains, and what is now Minahassan folk music is by and large based on the musical idiom brought in by the missionaries. Many missionaries were recently converted Ambonese islanders themselves, which probably accounts for the striking similarity between Ambonese and Minahassan folk music. Thus, one could describe Minahassan folk music as a worldly derivative of Ambon-mediated Dutch Christian music.

SIMPLE DIATONIC INSTRUMENTS

These diatonic instruments were used everywhere in the Minahassan schools and churches. Later on, so called *kornos* (also called *tenors*) were added to provide the harmonic and rhythmic backbone: bamboo receptacles the player presses air into with a longer piece of thin bamboo tube tapered at the far end, called an *anak* (lit.: child). On first sight playing a *korno* looks much like drinking a giant ice cream soda in some respect an appropriate connotation, since tradition has it that these instruments were developed from drinking vessels. The *korno* is a lip-buzzed instrument, like a trumpet or more appropriately a tuba. The actual sound is produced by the long mouthpiece, the receptacle adds volume, tone and depth. Note changes were originally effected by means of holes in the receptacle, by hand stopping, by a change of embouchure or by any combination of these techniques. The resulting sound is both soft and buzzing, but the instruments carry well. However, they lack the attack that we would associate with a tuba or a trumpet – but attack was not what the missionaries wanted to inspire in their flock anyway, and the songs to be played were invariably slow and wailing.

The missionaries would probably be amazed to hear the present day musical offspring of their Christian flutes and *kornos*. Thundering bands have emerged all over the Minahassa, playing saxophones, tubas, horns and basses in the finest brass band tradition. There is one big difference, however: all instruments are purely local inventions.

Flute and *korno* bands sprung into life from the 1860s onwards, mostly playing Christian and school songs. The big change to a more solid ensemble took place in the early 1920s, when large scale music festivals were organized in honor of the Dutch Queen Wilhelmina. Enterprising band members started copying European brass instruments in bamboo, and by adding a military type drum-set they were able to produce a full and versatile bamboo band sound. Through a system of government-sponsored competitions the idea quickly spread, and in a few years all Minahassan villages had their bamboo replica brass and flute band.

Most of these bamboo instruments were made by the band players themselves, and since Minahassans are expert bamboo workers, the instruments turned out to be excellent both in sound and in tuning. The shape of western brass instruments was faithfully copied in bamboo, and tone changes were effected by large holes or by a slide. Still the old *kornos* were never discarded, and up to this day they form the harmonic backbone of every band. These faithful, hardworking instruments clearly deserve a description.

THE KORNO

Kornos have a range of three or four semitones, and they are named after their fundamental, their range, or they simply go by number. Thus the highest *korno* is called either a "*do*" (the natural), a "*doremi*" (the range), or a "*number 1*" (the highest);

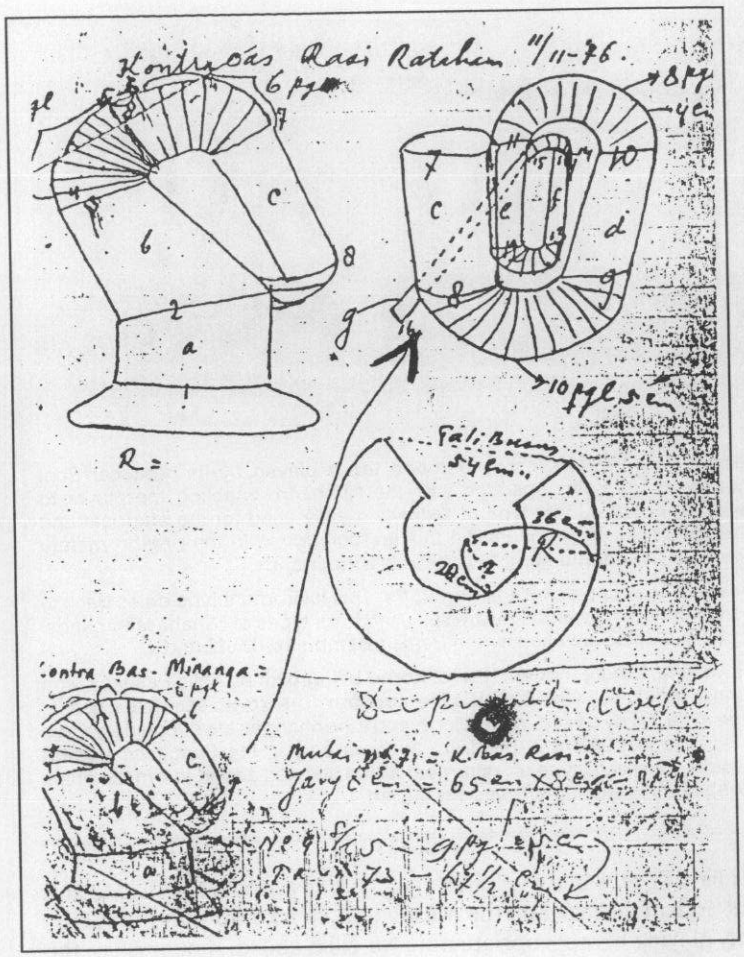


Figure 1A

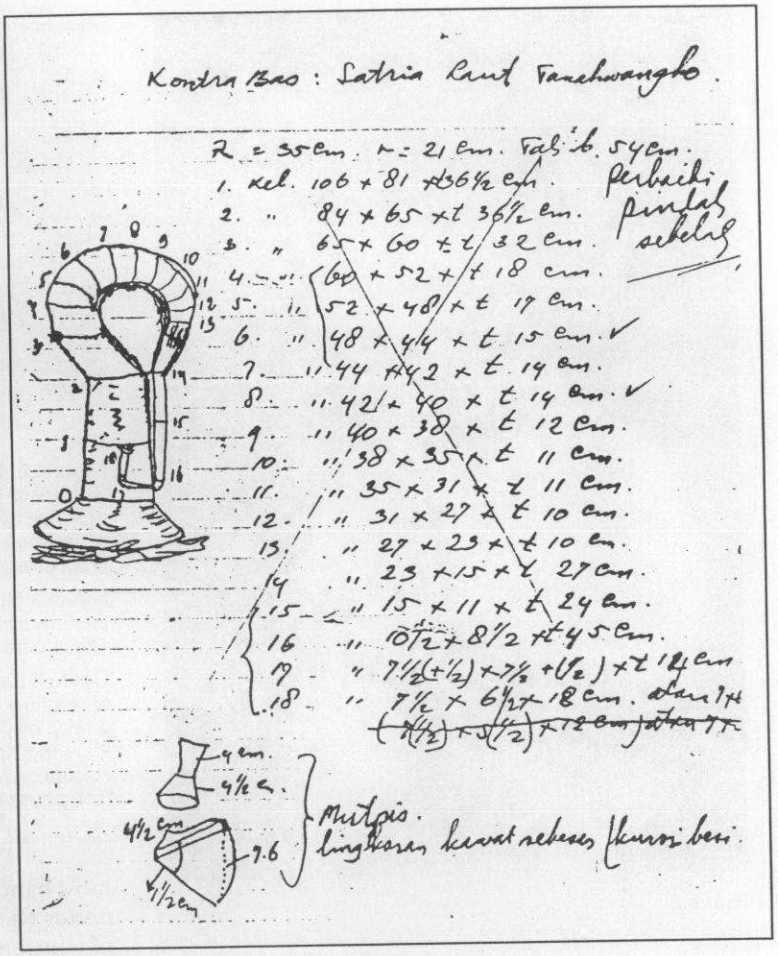
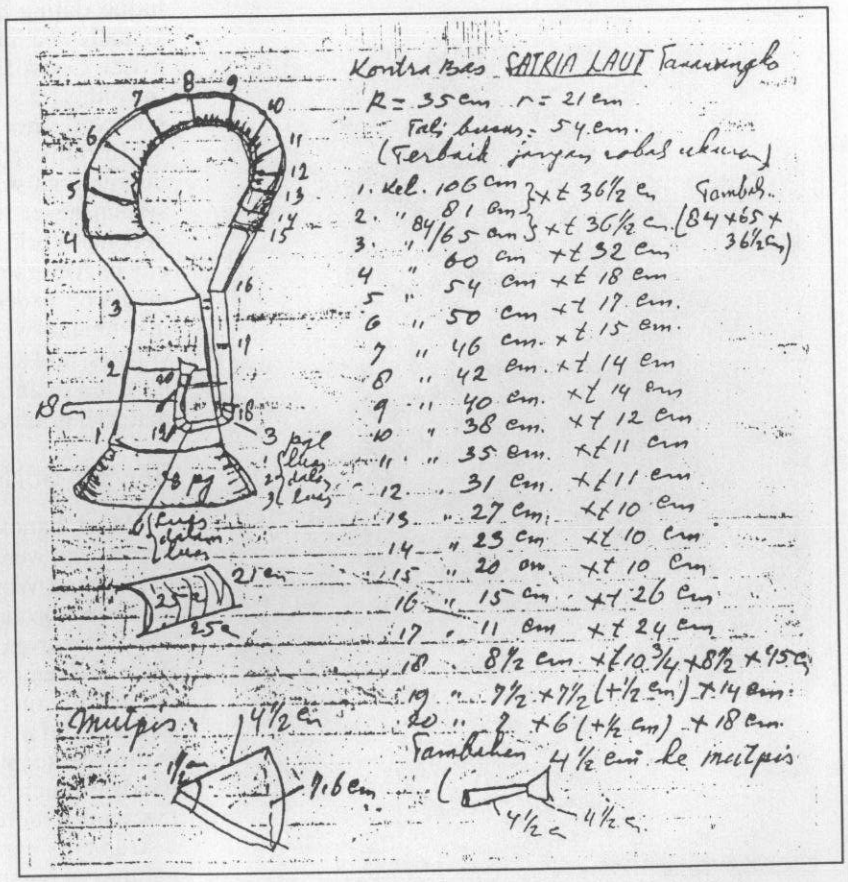


Figure 1B



Fiigure 1C

These drawings by the late instrument builder Justus Pasuhuk clearly show how the Tanawangko and Ratahan **kontrabas** differ not only in shape, but even in concept. The Ratahan bass is played like a western tuba (1a), but its Tanawangko counterpart is played from the shoulder like a bazooka (1c).

Although the drawings are not dated, I would guess that the shoulder blown specimen was a new development when Justus Pasuhuk made these drawings. He had nothing to go by, and first made a concept drawing (1b) that apparently did not work, since the drawing is crossed out. Later on – from the position the drawings have in his notebook I would estimate about a month later – he made the final drawing with slight but important changes in measurement. This is the **kontrabas** that he actually built, and two of these instruments still have a position of prominence in the Tanawangko band. When these drawings were made in the early sixties this instrument was still called a **kontrabas**. Nowadays they are usually called **susafons**.

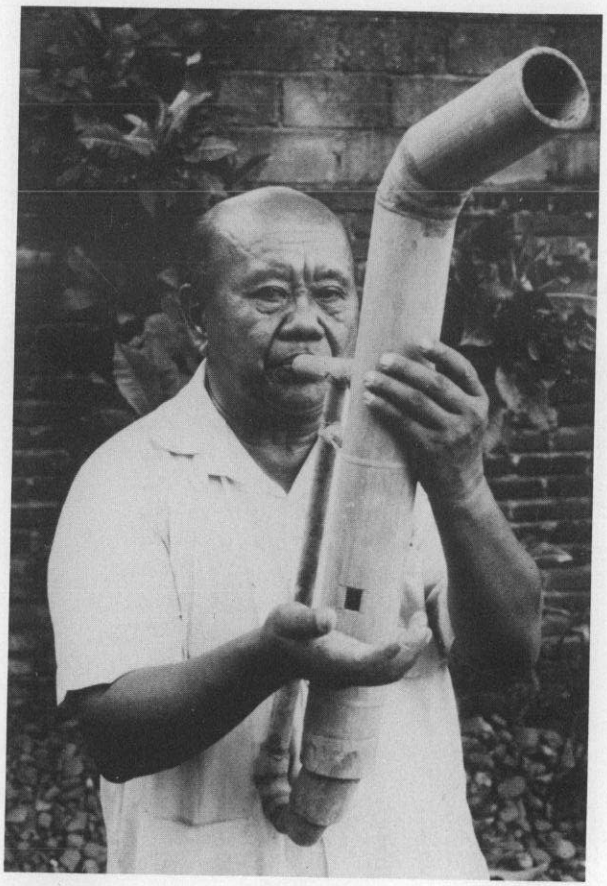


Figure 2

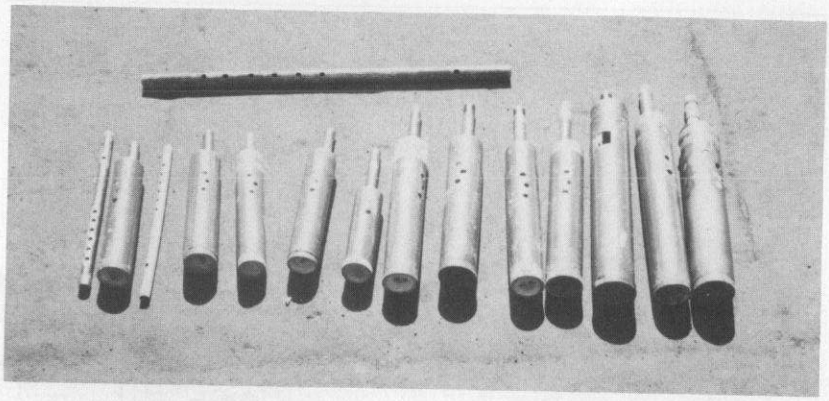


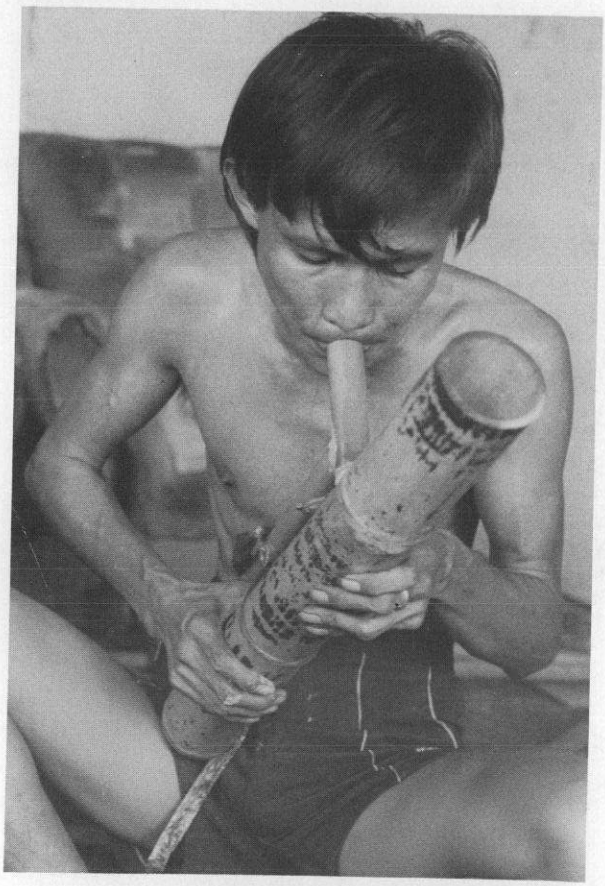
Figure 3

Fiigure 2 (left): A modern Sangir-style bamboo **tenor** played by its producer Boni Samau. It has two large holes operated with the full hand, enabling the player to produce five different tones. This type of **tenor** is mainly used for the afterbeat and occasional bridging licks. Instruments like this are only found in the **bambu melulu** orchestras, never in the **bambu seng** or **bambu klarinet** bands.

Figure 3 (above): A selection of **kornos** and **floits**. This instrument type dates back to the times of the missionaries, and they are still used in all types of Minahassan bands. These particular examples are used by the Berlian **Bambu klarinet** band.

Figure 4 (below) left): A more modern type of **korno** being built by Frike Pasuhuk, son of the now deceased Justus who invented the **susafon**. The **korno** seen here has its **anak** blowpipe replaced by a fixed mouthpiece, and tone changes are effected by three fingering holes. The instrument in this form survives only in the Sangirese **bambu melulu** orchestras. This is the type of instrument a zinc bell was added to it in the fifties (see photo # 5), but this experiment was short-lived.

Figure 4



most bands have *kornos* in seven pitch ranges. They provide both *slag* and *naslag* (beat and afterbeat), and the musical life of a *korno* player consists of constantly playing his appropriate note for each chord. If necessary, the conductor announces which chord is to be played by finger signs, a technique dating back to the time of the schoolteachers and missionaries. Usually one finger means the chord of C, four fingers F, an open hand or a fist is G, two fingers is D minor or E flat major, and a thumb placed against the index finger means a song is about to finish. There are many variations however, since every bandmaster has by now developed his own system.

In the early thirties, zinc and tin extensions to the original bamboo instruments were added (sadly, none of these remain today), but this system never worked well due to differences in timbre. Just before the Second World War, an enterprising Chinese stovemaker from the small city of Amurang started making simplified zinc copies of Western instruments on order of a music shop in the capital. This idea caught on, his instruments were copied by other stovemakers and zinc workers in various villages, and since that time a great number of adaptations and inventions have led to an astonishing variety of locally developed zinc instruments, a material gradually replaced by sheet copper in the sixties.

BAMBU SENG AND BAMBU MELULU

Most bands started replacing their bamboo instruments (save the *kornos* that were allowed to stay on) with these novel inventions just before the Second World War; this music form is now called *musik bambu seng* (lit.: bamboo zinc music). The older ensembles with bamboo instruments only were given the name of *bambu melulu* (lit.: bamboo only). One finds these last bands especially in the Sangir islands, and within the Sangirese community on the mainland. Most brass players will claim that the Sangirese could not afford the new inventions, but to the Sangirese it is also a matter of keeping a proud bamboo tradition alive. The sound of these bands is much softer than their zinc counterparts, and the repertoire still owes much more to their Christian heritage. From the Sangir islands these instruments spread to the Philippines, where one can still find a small number of bamboo bands today.

In contrast with the bamboo instruments, making zinc and copper

instruments has become work for specialists. Usually these are carpenters or stove-makers, and invariably they are music arrangers and bandmasters too. Being a good musician is almost a prerequisite for an instrument builder, since he will then be able to sell his own instruments to a band interested in his services as a bandmaster. The instruments are not cheap – a nine piece set will cost up to 3 million Rupias when made in copper (the equivalent of $1500 US $), and roughly half that price in zinc.

The instruments are built using simple paper templates, molds, or sets of drawings. Both straight bugle-type and bent horn-shaped instruments are built from up to thirty different pieces, each adding a little bit to the final form. The parts are hammered over a mold or an anvil and soldered with a kerosene burner. Most instrument makers have started business by secretly cutting up an existing set of old instruments (although most of them will never admit this), copying the measurements, and building their own set. Refining these and adding novel elements is then a matter of experience, and of coping with the precise requirements of the customers.

MINAHASSAN BRASS

These fantastic contraptions are clearly Minahassan inventions or adaptations, but their names date back to the colonial time. Thus a *tuba* denotes a bass instrument having either a semicircle or a straight bugle form in various tube lengths, nowadays constructed with the added benefit of a sousaphone type bell. A *tobalos* (lit.: loose tuba) is a tuba played as a singleton, in contrast with the other tubas played in pairs. The term *tubalos* might also relate to the fact

Figure 5 (above): This is an early hybrid orchestra type, extinct after the Second World War. The main body of the band still consists of **floits** and **kornos** taking up a place of prominence, but the bass instruments in the back have zinc extensions. The system of zinc extensions to bamboo instruments did not work properly, and they were replaced by all-zinc instruments in the fifties, giving rise to the **Bambu seng** and later to the **Bambu klarinet** bands.

Figure 6 (below): Three modern zinc instruments made by Bert Raco. He is seen playing a **susafon** on the far left. Next to him a **sola**, and on the far right a **saksofon**. The instruments in front are another **sola** on the left, and a **remifa** on the right. Although these instruments are built in zinc, Bert takes great care to cover them with copper paint so they will look like real brass. The material the instruments are made of has no effect on sound quality.

that the instrument has a wider bore and a separate *monstuk* (Dutch: mondstuk = mouthpiece); normally the mouthpiece is an integral part of the instrument. A *bas* is a spectacular once-wound contraption with a forward-facing sousaphone bell, worn on the shoulder; an *overton* (sometimes called *trombon*) is a large bugle playing bridging licks and lead notes.

The only brass instruments that do not derive their name from either the Dutch or the international standard vocabulary are the elegantly crooked *sola* and the *remifa* (guess what notes these instruments produce); these have taken up the part of bamboo *kornos* producing the same notes. A specific form of *sola* is a straight hunting horn, called the *naklang* (Dutch: reverb).

All instruments have a very wide bore compared to western instruments, which results in a rather harsh and not very stable tonal spectrum centered around the first harmonic. The range of each instrument is not more than four notes, and tone changes are made by three small fingering holes about halfway along the tube. Nonetheless, a good band plays its marches, waltzes and polkas in flawless harmony – from all folk brass bands outside the western world that I did research on, the Minahassan band is by far the best in tune.

BAND PITCH

The bands are keyed anywhere between B and D. One finds the odd band playing in D sharp, but never anything in the internationally standardized key of B Flat. This probably dates back to the time of the *suling* school flutes, made traditionally in such a size that schoolchildren could play them. A flute in C is about the maximum length an adolescent can handle; since the orchestras developed by adding instruments to these flutes, most band stayed tuned in the key they happened to start with. As a result, a good instrument maker must have a separate set of drawings not only for each instrument he makes, but also for each separate band. I acquired a complete set of such drawings, and these show how the instrument builder constructed the instruments for each band: first he would measure the tube length of one of their existing horns, then calculate the matching length of replacement instruments or new inventions, and finally break this down to parts. In these drawing books there is never any mention of a standard tube length, or a standard pitch. As a result, it is difficult for a band to change over to another builder unless a complete new set is ordered, and this is why the builders jealously guard their drawings, templates or molds.

BAMBU SENG AND BAMBU KLARINET

The combination of flutes, *komos*, brass instruments and drums is the standard setup for a *bambu seng* band. Just after the Second World War however, some bands started adding simplified copies of the alto saxophone and a so-called *klarinet* – in fact a soprano saxophone – thus earning themselves the name of *musik bambu klarinet*. It took some time before this addition was accepted; the combination of bamboo and brass had become the accepted standard setup, and *klarinet* bands were at first not allowed to participate in band contests. The initial reservation against reeds has by now largely worn off, but even today mixed forms do not exist; a band either opts for reeds all the way, or does not include them at all – just like in Europe, where a brass band and a military band are a different species. Even in a 50-piece orchestra, no more than four to six reed instruments are needed for a complete change of sound – a wide, wailing vibrato and an open embouchure ensure a

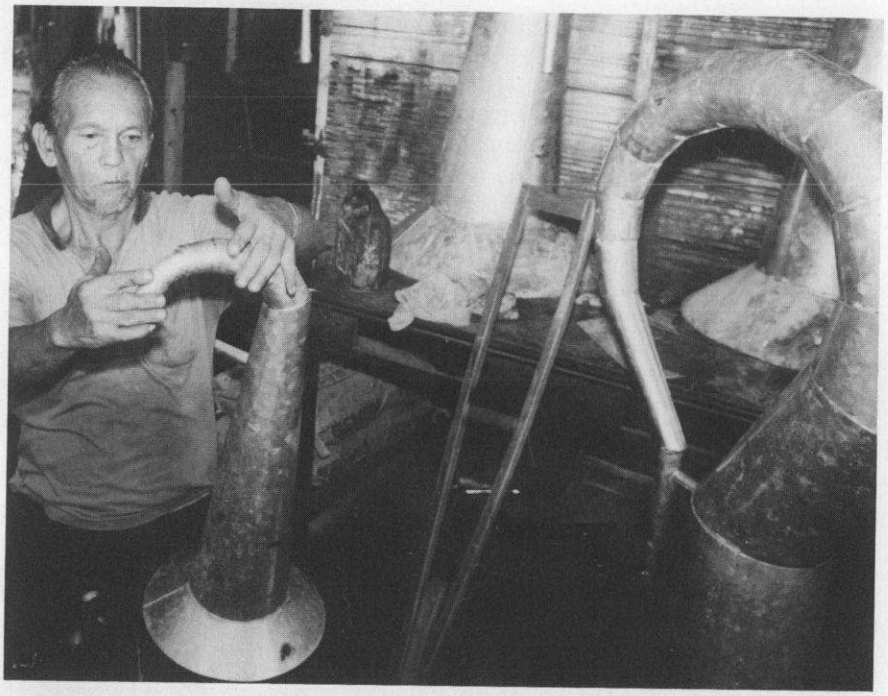


Figure 7 (above): Oom (Uncle) Frans Polii building an instrument called **overton** or **trombon**. Uncle Frans originally was a bandy builder, and he started building instruments only after he became the leader of the **Berlian** orchestra, in his fifties. To the right a finished but not painted **susafon**. Cutting the parts is a relatively simple job once a builder has the right templates, but the joinery work is done entirely by eye, and it is essential to acquire a smooth curve.

Figure 8 (below): Berlian, a modern **bambu klarinet** band, here conducted by its founder Opa (Grampa) Lenzun. This is the second oldest Minahassan band still in existence, dating back to the middle twenties. The present director is Frans Polii (photo #7).

penetrating sound, which is a perfect match for the booming brass sections. In such bands, flutes may be retained, but save for the piccolo their contribution is barely audible. The saxophone players are the real stars of such a band, and one gets the impression that the *bambu klarinet* music owes more to the swing orchestra than to the military band idiom so evidently present with their *bambu seng* and *bambu melulu* colleagues. Significantly, while playing brass instruments is a prerogative of the village elders (much to the discreet dissatisfaction of the adolescents, who have to content themselves with the much less exciting flute and *komo* until they grow old themselves), saxophones are played by the young-

men-about-town, indicated by sunglasses, heavily pomaded hair or a subtle extravagance in clothing. This is the only exception to the existing rule of age seniority: the old folks will cling to their enormous brass instruments till they drop dead, which obviously is not very helpful for maintaining or improving musical standards.

A VILLAGE AFFAIR

When walking around at night in a Minahassa village, there is always the sound of instruments – the band is rehearsing, or an individual will be playing quietly to himself. The band is very much a village affair, and most village members will belong to it at some stage in life. The musicians get a little money for playing, but with the exception of the bandmaster they are amateurs, playing for fun and relaxation; most of the money is needed for maintenance of the instruments anyway. This might sound quite familiar to Europeans and Americans; compared with other third world countries it is an exception, however. The former colonial brass or military band has inspired many folk successors all over the world, but normally these bands consist of musicians who make a living out of it. The Minahassa bands form an exception to this rule, probably because of the very tight village structure still widely found in this region. The village band is simply one of the various ways people get together, and helping out at a wedding or a public holiday is taken on as a matter of neighborly or family duties. Moreover, the traditional close connection with the church has worked against a professional band industry.

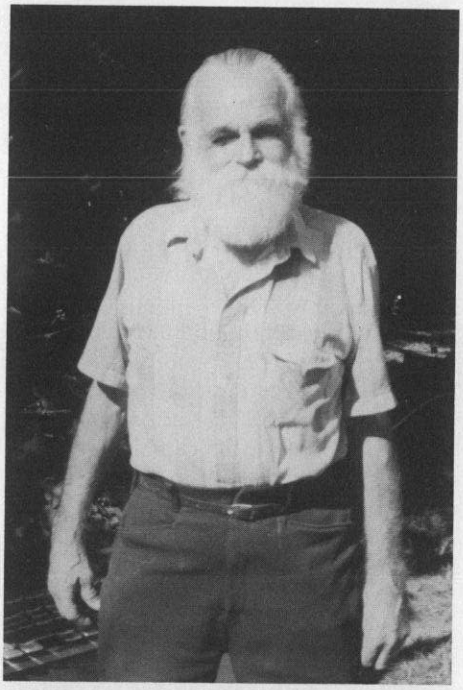
Weddings are the most important occasions the bands cater to, and such a wedding is almost a full day job. There are hymns to be played outside the church before and after the official marriage ceremony, and afterwards the band leads the procession to the large tent where the festivities take place. The musicians play marches and waltzes between speeches and during dinner, and then euphemistically 'go and tend their gardens' – for many this means going to a quiet spot to smoke and drink. At seven the band must be back to play dance music: the *Polinez* (polonaise), the *Kadrili* (Quadrille), the *Uas* (Waltz) and the *Skolcis* (the Scottish polka). An occasional tango or fox-trot adds a modern flavor to the performance, but the bands are not exactly well tuned to rhythmic finesse: a march rhythm is always shining through, no matter what song is played. Solos are never part of the performance, and the only variation is a gradual speedup towards the end of a song. Next to standards such as the "Beer Barrel Polka", "Alte Kameraden" and "La Paloma", a number of old Dutch popular songs and marches dating back to the thirties are still common stock. Their outlandish appearance notwithstanding, the bands still have a distinct European atmosphere in terms of arrangements and ways of playing, and in an international context this again is exceptional. Most other ex-colonial folk bands have drifted away from the original ways, and have adapted the European instruments to their own music. In the Minahassa by contrast the instruments have changed, but the musical idiom has remained distinctly European.

Adapted by the author from an article that appeared in **Brass Bulletin** No. 77 - I/1992 pp. 3847 (BRASS BULLETIN, International magazine for brass players, PO Box, CH-1630 Bulle, Switzerland)

Robert Boonzajer Flaes is an anthropologist at the University of Amsterdam, The Netherlands.

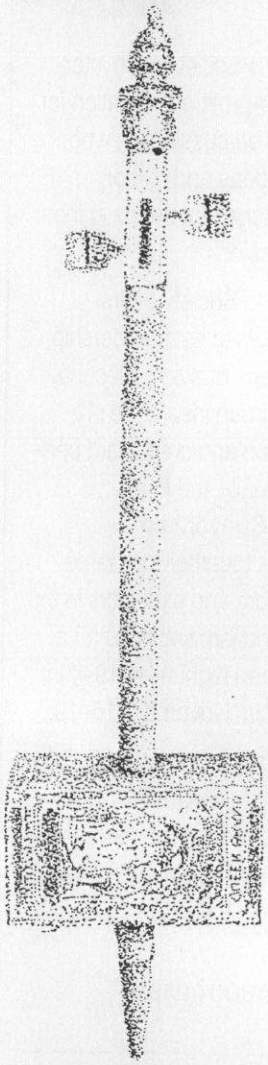
BILL COLVIG

By Sasha Bogdanowitsch



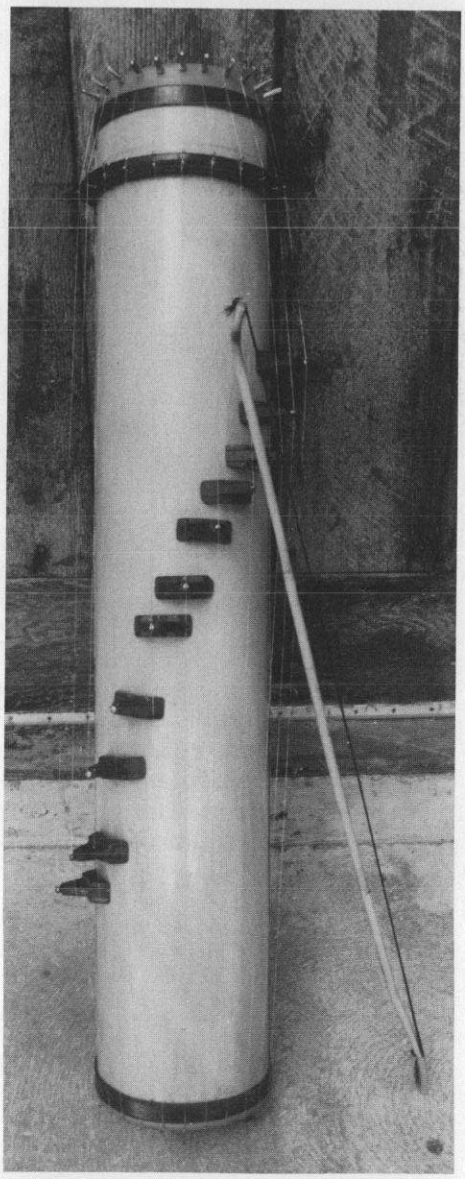
Born on March 13, 1917 in Medford, Oregon to a musical family, Bill Colvig was exposed to music at an early age. His father being a band master in the local schools led Bill to take up brass instruments, most notably the trombone. During his college years at the College of the Pacific and the University of California at Berkeley, he continued his concert band experiences, but majored in electrical engineering.

Working as an electrician in San Francisco from 1946 to 1967, Bill used frequently to visit the Old Spaghetti Factory where he saw numerous contemporary composers present their work. It was here in 1967 that he met the prolific composer and Asian music scholar, Lou Harrison, who inspired Bill to take up instrument building and the playing of Oriental instruments. Soon thereafter, Lou and Bill moved to Aptos, California, near Santa Cruz. There Bill became one of the foremost builders of gamelan instruments in North America, introducing new materials in traditional gamelan construction and new instruments for non-traditional use, combined with the use of the rational tunings of just intonation.



An important facet of Bill Colvig's instrument building has been his tremendous contribution towards the growth of the American Gamelan, the greatest examples being the *Gamelan Si Betty* of San Jose State and the *Gamelan Si Darius* and *Si Madeleine* of Mills College. Using a variety of materials, including such commonplace materials as electrical conduit, aluminum, and tin food cans, Bill recreated the full range of instruments of the conventional gamelan of Java . Traditional influences can be seen through his remodelling of the standard wooden trough resonator and iron slab metallophone, the *saron*, the bevel-edged bronze keyed tube resonator metallophone, the *gender*, and the small bossed gong chimes, the *bonang*, and the end-blown ring flute, the *suling*.

But Bill Colvig ventures from the conventional Javanese constructions frequently in his instruments' register expansions, tunings, and "American" materials . Although a majority of the construction was modeled after UC Berkeley's Javanese Gamelan, *Kyai Udan Mas*, there are many exceptional forms in Bill's constructions, like the unique bossed octagonal aluminum plates of the *bonang* and the large iron slabs and resonators for the *kempul*, the conventional suspended bronze gongs. An exhaustive overview of all of Bill Colvig's gamelan constructions would be too large for this publication, and since all the instruments' design and construction are noted in the **Mills College Gamelan** book (reviewed in EMI Volume IX #2), this article will focus on only three of Bill's gamelan recreations, including the popular idiophone, the *saron*, from *Gamelan Si Betty* , an Indonesian chordophone , the *celempung zither*, and the widely used fipple aerophone, the *suling*. Along with these three instruments, the major focus in this article will be on Bill Colvig's unique individual creations that take inspiration from the traditional instruments of ancient Greece, the Orient, and medieval Europe, combined with the influences and ideas of longtime friend and collaborator, Lou Harrison.



Drawing above: Gitchak. Drawing by Robin Goodfellow.

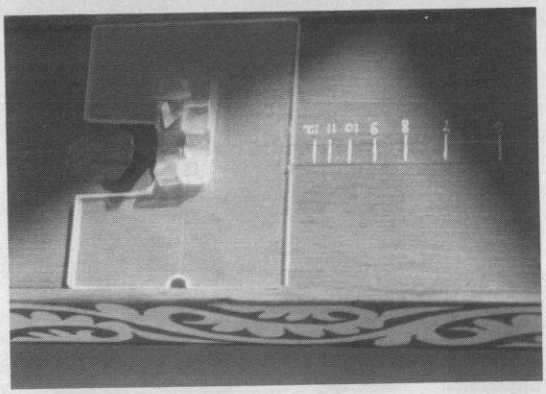
Photo at right: Bowed Psaltery made by Bill Colvig. All photos in this article by Sasha Bogdanowitsch

Having its earliest known traces from Greece in the 5th Century BC with the theoretician, musician, and healer, Pythagoras, the monochord was and still is the most useful tool in measuring musical pitches within the various modes and intervals in Nature's harmonic series. It is because of this fundamental usage and principle that it is mentioned first, for it is in this sense the father of all instruments. Quite simply, the instrument is a single string stretched across two fixed bridges that are erected onto a sound box of some sort. Usually a movable bridge is situated underneath the string, dividing it into two parts. Marks on the instrument demonstrate the positions where this bridge needs to be in order to obtain the certain harmonic proportions.

The picture above is of an earlier model of the **monochord** that Bill created before he perfected the easier-to-build "tweezer" monochord, whose details on construction are specified at the end of this article. It is built from pine, mahogany, and plywood, with piano end pins from a ruined piano of Lou's and using a pipe/nail tuning device for tuning the pegs. Underneath the soundboard, a heavy metal pipe is set to insure stability and provide the most needed support and accuracy in keeping the monochord in tune. Incidentally, this special monochord has served Bill and Lou very well and has been a constant companion on their trips around the world to such varied countries as Japan, Czechoslovakia, and New Zealand.

The **Standing Harp** (near right) was designed to be used in conjunction with the monochord and was built to realize and explore the modes that were discovered from its one-stringed ancestor. To ensure fine tunings it employs two different tuning mechanisms for each string. It takes its design from the Chinese vertical harp called the *konghu*, which spread to China via the Silk Route during the Han Dynasty, 200 BC to 200 AD, from the Near Eastern countries of Mesopotamia. Its beautiful painted designs are by Lou Harrison.

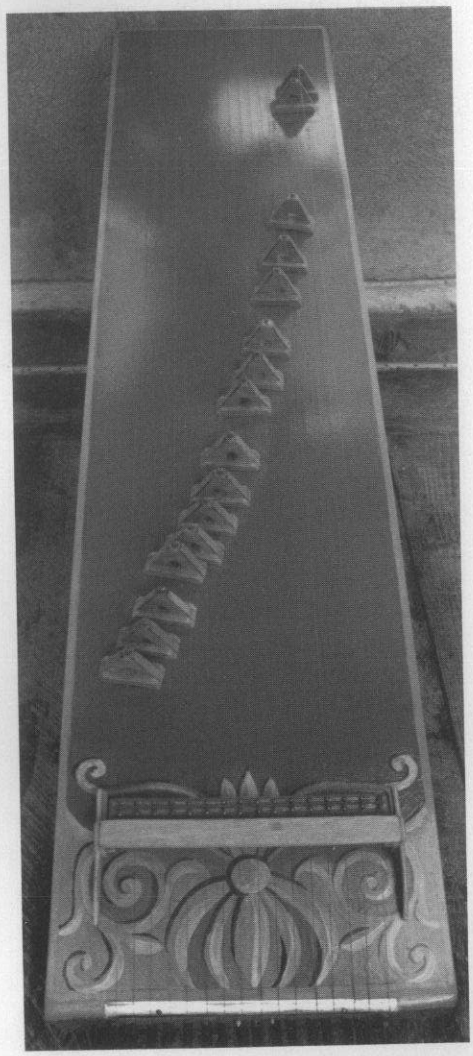
The **Psaltery** (plucked zither , shown at far right) incorporates the sonic elements of the Western medieval psaltery, with the Chinese



Above and left:
Monochord made by Bill Colvig. Decorative work by Lou Harrison.

Below left:
Standing Harp.

Below right:
Psaltery (plucked zither).



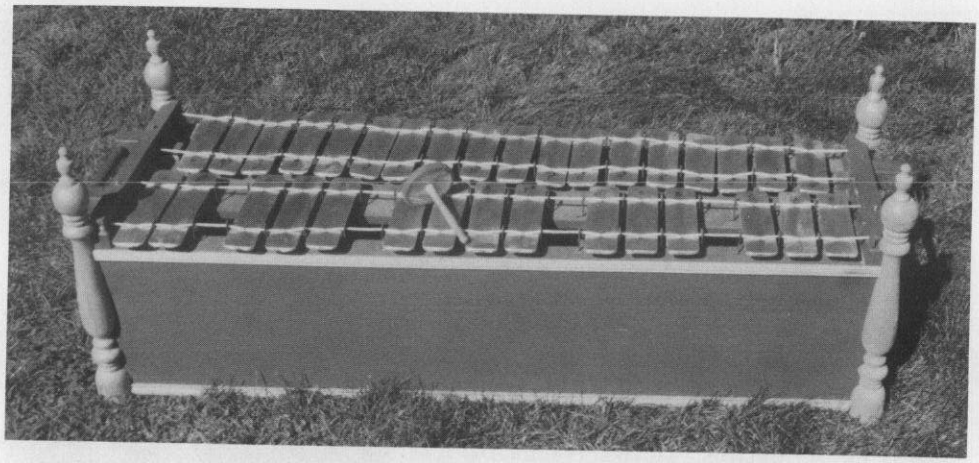
Right above: Ptolemy Duple Metalophone

Center right: Saron from Gamelan Si Betty

Below left: Peghead for the gitchak (the full instrument is shown in the drawing at the start of this article)

Below center: Celempung

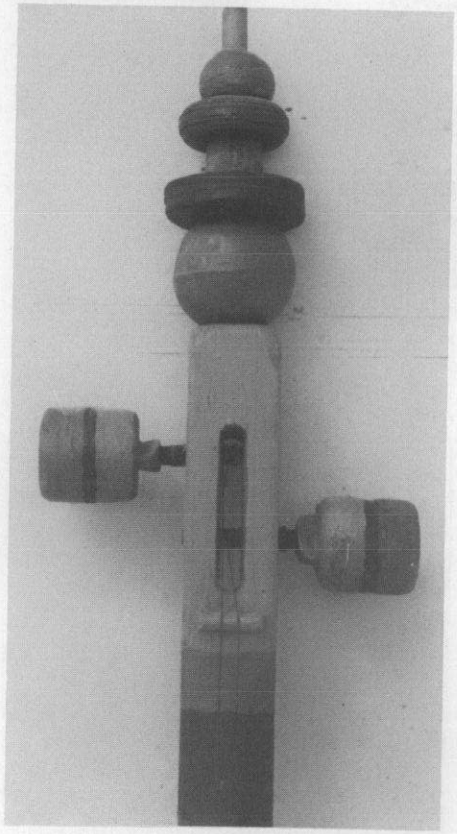
Below right: Suling

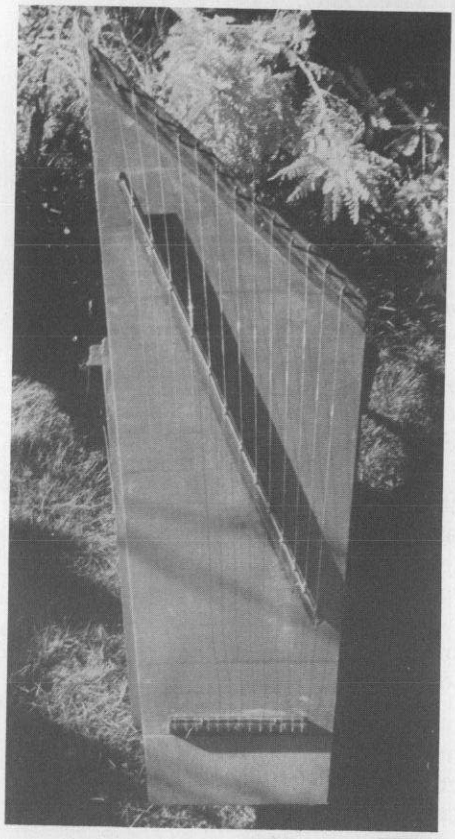


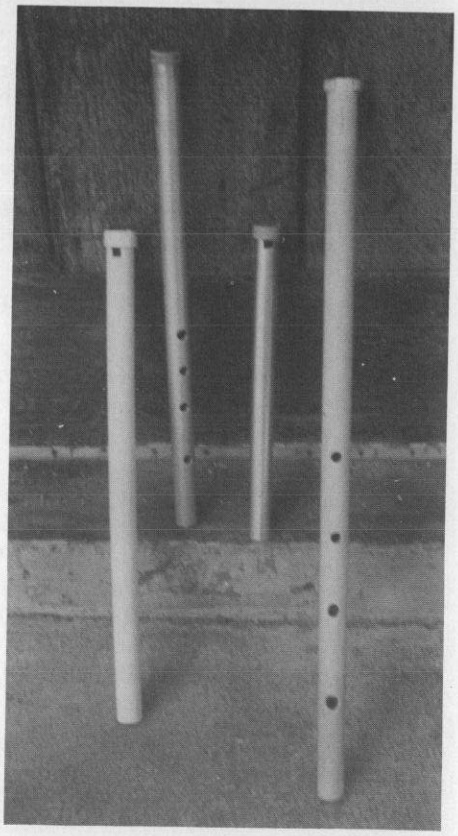
pitch modulation bridges of the *cheng*, and the visual appearance and boxlike structure of similar instruments around the world. This particular one was made in New Zealand where Lou had a Fullbright Scholarship, using the local wood materials and standard zither tuning pins. Of special note are the unique wooden bridges that take inspiration from the *cheng* and Vietnamese *dan tranh* bridges known to symbolically represent a flock of geese, and the special wooden platform designed to orient the fingers of the player to where he/she is on the instrument.

The **Bowed Psaltery** or *yacheng* is a unique zither rarely found throughout Asia. Originally from China, dating back to the Tang dynasty, this ten stringed instrument has counterparts in Korea, where it became the *ajaeng*;the seven stringed bowed long zither used in traditional Korean court music, and Mongolia, where it became the *yatugalig*.

The story of the origin of this instru-







ment is an interesting one. Lou and Bill used to have in their possession a traditional bowed psaltery and boasted the rareness and invaluability of it, which seemed to prompt a break in at their house where it was stolen. Not knowing it was really missing until it was desperately needed in an upcoming music ensemble, Bill decided to build his own. After several experiments, he came up with a version he liked better than the traditional one, shown on the first page of this article. Bill's instrument uses thin birch plywood, zither tuning pins and plastic bridges from Taiwan, and is played with an erhu bow, while it rests on a four-legged wire stand to facilitate playing and increase resonance.

The **Gitchak** is a modern version of the Afghanistani instrument with the same name. It was inspired by a photo on the back of a record jacket, and is related to the more popular *sarinda* from southern Afghanistan and South Asia, where it appears as a double-chested fiddle used in exorcism and curing melancholia. This version's resonator is from an olive oil can (copied from the record jacket) and its two strings are tuned a fifth apart and played with a cello bow (shown in the drawing at the start of this article and in the peghead detail below).

Inspired by the duple divisions of the tetrachord written down by Greek mathematician and music theorist, Ptolemy, the **Ptolemy Duple metallophone** (preceding page, middle photo) is a *gender* hybrid designed for Lou's piece, *Homage to Pacifica*. It utilizes aluminum bars and tin can resonators, hidden by the ornate painted wooden box surroundings crafted by Lou himself. It is played with traditional *gender* padded, disc-shaped mallets, but is not intended for the dampening technique that the usual instrument often requires.

The Indonesian style zither, the **celemplung**, is made from pine, mahogany, and plywood, in the shape of a large trapezoid. Bill's instrument (below center) sits on four legs, two longer than the others, making it slant upwards for the performer, who plays it by plucking with fingers or plectrum .This version had more resonating capability than the Indonesian ones, as noted even by Indonesian instrumentalists.

In the aluminum metallophone, the **saron** of *Gamelan Si Betty* (below right), Bill has expanded the traditional instrument's range to encompass ten keys instead of the traditional six or seven. The traditional trough resonator is made by a delicate process of bending and gluing the thin plywood, accommodating less space for the higher notes and more for the lower notes; a much different procedure from the carving of wood that the Indonesians specialize in.

Lastly, Bill's bamboo ring flute, the **suling**, like the bowed psaltery, was made out of need from a pre-existing traditional one. Using the readily available materials of PVC and aluminum, Bill was able to take measurements from the suling of the West Javanese *Gamelan Degung* at Berkeley to make an astoundingly beautiful and cheap instrument. Usually the fipple mouthpiece is made from a wedge-shaped hole cut in the node of the bamboo and covered slightly by a thin bamboo ring which guides the air stream between the hole and the ring to obtain the sound. Bill constructed his from a wood plug , a thin slice of PVC, and epoxy to hold it all together.

The coming issue of **Experimental Musical Instruments** will feature an article by Bill Colvig on making a simple metallophone.

SOFTWARE-O-PHONES:
Homemade Software Instruments

By Henry Lowengard

EXPERIMENTAL SOFTWARE INSTRUMENTS

Computer music is a widening field which encompasses commercial synthesizers and samplers, their associated sequencers, effects devices and digital recording editors. In the old "rough-and- ready" age of electronic music, there was a tendency to explore sound as sound, mostly because the level of the tools allowed little else. Now the pendulum has swung the other way – using modern electronic instruments, the tendency is to call up some imitative program and treat it as a glorified organ stop. The MIDI standard also lead to the "pianification" of commercial synthesizer controllers. Yes, there are alternate MIDI controllers: wind controllers, guitar controllers, voice trackers – I have some of them myself. Yes, cheaper memory and higher computing speed has lead to some amazing sounding devices. However, the element of exploration seems to be gone.

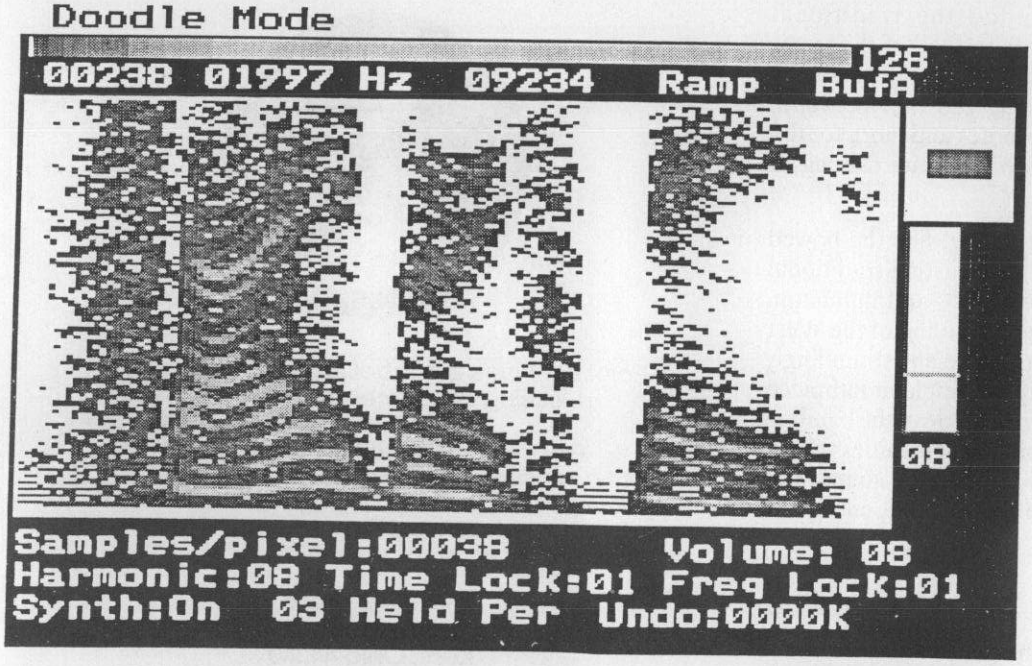
A few years ago, after having spent many years building oscillators, taping them, and tearing them apart, and years of steady computer hacking, and even a little home customizing of a commercial keyboard, I decided that the personal computer industry had matured enough so I could write my synthesizers instead of building them. The machine which best allowed this was the Commodore Amiga. All of the following programs run ONLY on Amigas. These programs are also in the public domain and are found on some BBS systems or can be obtained from me. Send a blank disk and an idea of what you want (and maybe a nice kitschy Colortone™ postcard or two) and I'll send it back. Remember: in my case you are only fully licensed if you give a copy to someone else!

RGS, A SONOGRAM PAINTING PROGRAM

Spectral analysis is a powerful method for discovering underlying structures in sounds. This analysis separates a sound into an orchestra of sine waves, each at a constant frequency but varying amplitude. This analysis leaves you with a lot of numbers, which fortunately make more sense when expressed visually. A sonogram represents amplitude as a range of color or a gray scale in a flat plane. Timbral aspects of the sound become clearer in a sonogram: for example, variations in harmonic content and frequency show up as wiggly lines and blobs. My program RGS (Real-time Graphical Synthesis) develops from a simple idea: to "paint" a sonogram directly, in the manner of other computer painting programs, while simultaneously synthesizing the sound that sonogram represents. In RGS, you are painting amplitudes (using a mouse or graphics tablet) into a "canvas" of fixed frequencies organized in a series of skinny time frames. The sound which corresponds to the painted sonogram plays in an endless loop, at a speed based on the sample playback rate and the number of sound samples each time frame controls. The same sonogram can be reinterpreted with different time scales and frequency ranges.

The painting tools in RGS are different from the ones used in other computer paint programs, because time is different from frequency. The tools are more horizontally oriented, in order to put correlated sound into time. There are special tools which draw harmonics – lines equally spaced in frequency – and also to erase everything BUT harmonics from a complex sonogram. There are time and frequency constraints which let you build rhythms (constrained time) and very pure harmonic material (constrained frequency). RGS can analyze a sound sample into its sonogram as well, which you are then free to edit and resynthesize. You can save out the synthesized sample (in Amiga's IFF 8SVX format) for use by other programs.

Because it works immediately, it can be also used as a musical instrument, although I'd have to say it's hard to synchronize it with other processes because of the looping nature of the sound. RGS is also a MIDI controller where each of the 128 frequencies corresponds to a MIDI note. You select which time frame gets played by dragging the cursor over the sonogram with the mouse. When used this way, the program filters out all but the loudest 16 or so of the harmonics in each frame so the attached MIDI synthesizers won't over-

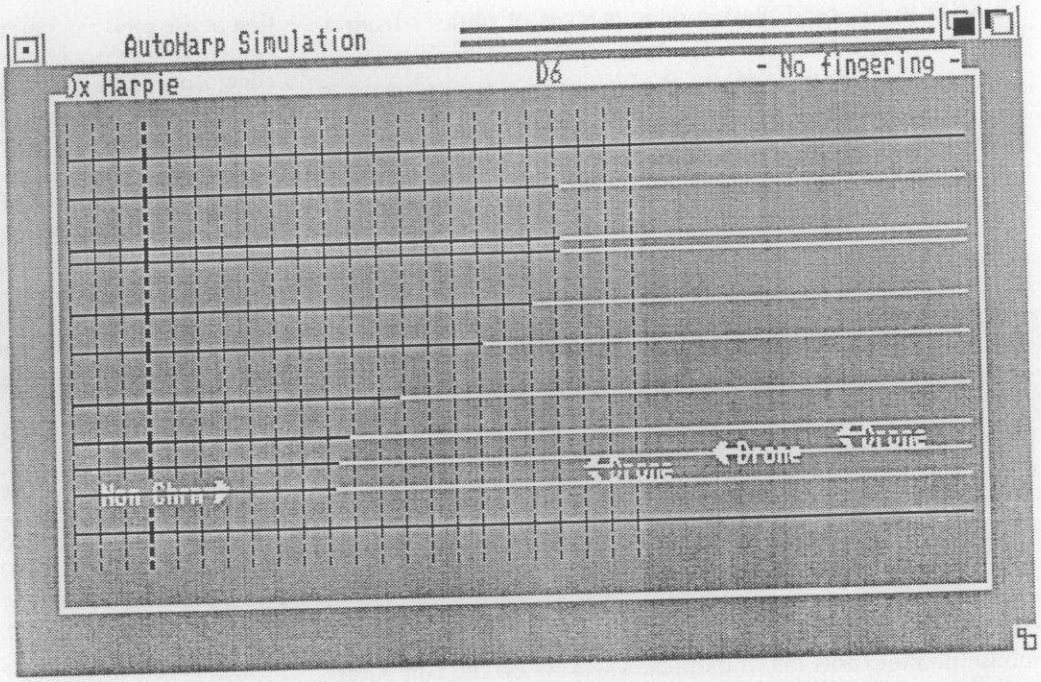


The graphics on this and the following pages are computer monitor screens from the programs described. This page: RGS: the sonic spectrum painting program. This is the sonogram of the word "cyberspace."

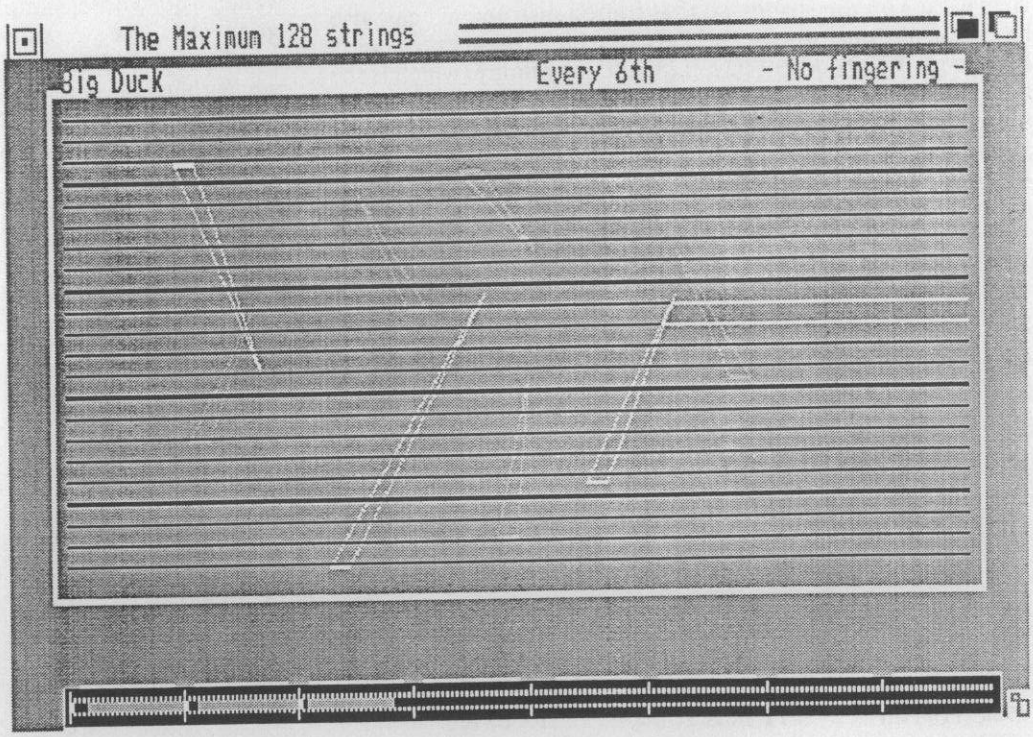
flow. If the synthesizer is retuned microtonally to a "scale" of harmonics, it can do a crude reconstruction of the drawn spectrogram! You could capture this MIDI stream and bring it into a scoring program (to make parts for very gifted orchestra) or simply use RGS as an immediate graphically based controller for a variety of MIDI peripherals.

RGS can resynthesize a portion of the spectrogram in "non-real time" at a higher quality than the real-time synthesis. This way you can isolate the sound of individual formants in speech, or otherwise build up a complex sound in piecewise manner.

People always ask me what some picture would sound like if treated as a sonogram and synthesized this way – but don't realize that a vertical line is the equivalent of mashing the keys of a 128-key pipe organ and that dense horizontal lines become distorted throbbings as the loud, close harmonics create a loud, low difference tone. Well, maybe in certain contexts, it wouldn't be out of place ... but RGS is primarily meant for developing a sense of how sounds can be constructed out of sine waves and the equivalence between timbres, chords, beats, rhythms and entire compositions.



Above: LYR – a software version of a chorded zither. The white strings are playing with MIDI velocities proportional to the length of the white part of the string.



LYR's sequencing system saves and plays back strums, but not notes or chords.

HARM, A SOUND EFFECT INSTRUMENT

There are a lot of good quality sound effects devices available now. Some of them allow the properties of their effects to be controlled by MIDI devices in a live, interactive way. However, there are a lot of times when I've wanted to explore effects which either don't exist yet or aren't in the machine I personally own, or just want to try out effect ideas for myself. That is the idea behind my program HARM. HARM provides a framework for creating sound effects digitally so that new effect experiments can quickly be written. Usually some aspects of the effect are controlled by the computer's mouse and keyboard – or even MIDI – but the range of options is kept simple so they may be changed easily in performance. Some of the effects HARM can do are:

independent stereo pitch shifting,

playing a short sample as if it were autoharp strings,

real-time backwards pitch shifting,

variable amplitude modulation,

real time "slowing down" of incoming sound,

pitch detection combined with pitch shifting to "monotonize" an incoming sound,

MIDI-controlled transposition of live sound,

MIDI transposed playing of sequences of phrases from a short sample,

and other noise-making effects. Because of the unusual nature of the effects, HARM even makes interesting feedback noises. All of these effects also throw related bands of color on the computer screen, which can be easily sent to a projection television or other video processor. Some of my new effects only provide video!

HARM effects react rapidly enough to give the feel of a musical instrument. I've developed playing techniques involving subtle trackball wiggling and carefully controlling the input volume and feedback levels by cupping my hand over the microphone. The MIDI controlled effects take on new powers when controlled by a MIDI guitar or Casiohorn.

I went on the air at WBAI-FM earlier this year at the graveyard hours of 1:30-3:30 AM and HARMed listener phone calls. The phone lines were quite jammed.

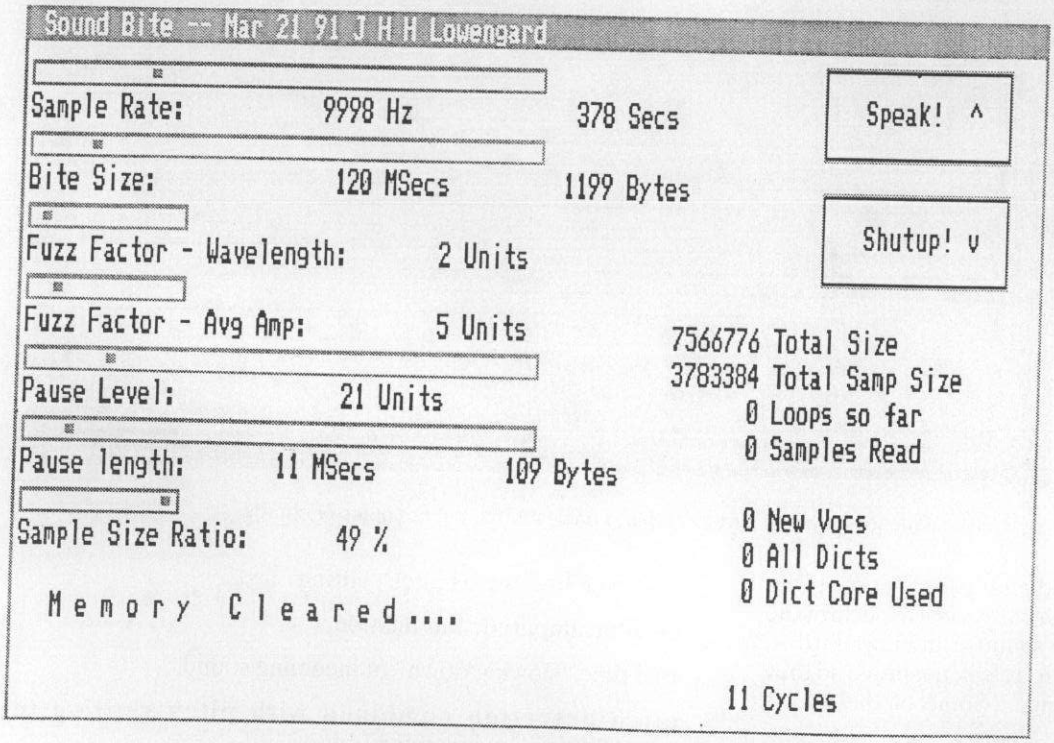
LYR, AN EXTENSIBLE MIDI AUTOHARP

The first instrument I wrote was called LYR (pronounced "lyre"). LYR is a MIDI controller which acts like an extended autoharp™. A series of strings appear on the screen and the mouse pointer turns into a flatpick. The keys on the computer keyboard act like the chord bars on a real autoharp™ – they disable sets of strings from sounding. I can have some 92 chords set up this way. The strummed notes keep playing until they are either damped by the appropriate chord bar, or until they are recycled for use in another chord. The same chords can "finger" virtual frets on the strings, so that fretted instruments can also be simulated and strange hybrids can be experimented with. Most synthesizers do not have 128 note polyphony (which is the maximum that LYR can play simultaneously), so LYR provides recycling to keep the synthesizer from making its own decision about which notes to keep playing when it overflows. When the string is plucked, additional information can be sent: the position of the pick can determine the MIDI velocity, pitchbend or control value associated with the note it plays. This gives a lot of control over MIDI parameters in an easily accessible way. However, a single strum over the strings is the extent of mouse control. There's no way to simulate fingerpicks! I've tried to remedy this with a tiny sequencer which sequences the strums and allows them to be drawn over the strings in their proper places. It does not sequence the chords,though, which are chosen "live". Musically, the paradigm of autoharpery translates into stable, formant-like ranges of properly inverted chords. Or, when controlling a MIDI drum kit, a very strange drummer! Its explicit control over note assignment and velocity makes for very cleanly controlled and visualized clouds of sound.

BITE, AN AUDIO TRAVESTY PROGRAM

One of the interesting back alleys of computer art is the travesty program. This is a program which analyses some text and generates variations of that text which are similar in style to it. Some examples are "Racter," which "wrote" the book *The Policeman's Beard is Half Constructed* in the early 80s, and, in the musical world, the Mozart pastiches done by David Cope. I've written a program, *Sound Bite*, which does the same thing for audio material. A longish sample is taken and chopped up into word-like "bites". These bites are crudely keyed by average wavelength and amplitude, and then matched to a growing vocabulary of other sound bites. BITE then creates a simple sound grammar by keeping track of which bites follow which. When the whole sample is consumed, the program then generates a new sound stream using the grammar and vocabulary. BITE can be put into a cycle where it listens for a while, then generates, then listens and so on in an unattended manner. Leaving it listening to talk radio or television it sometimes comes up with a bizarre precis. The generated sound usually skips and stutters like a broken record, and with music it is similar to having a phrase stuck in your head repeating from different points, skipping around to the "hooks" or even picking out small sections obsessively for no apparent reason. BITE sometimes produces (uncovers?) strange "hidden meanings" out of speeches and other vocal material.

I don't save any of the computer data generated with BITE because it takes a lot of memory to store, and it's meant to be an effect and not something predictable. The idea is to let it develop its own personality.



SOUND BITE's control screen lets you change aspects of its phrase recognition algorithm. Hard-to-miss buttons start and stop the sound generator.

Henry Lowengard is a New York based computer programmer, animator, microtonal musician and autoharpoholic. Send queries to jhhl@panix.com or 43 W 16th St. #2D, New York, NY 10011-6320. Include a SASE, floppy disk, postcards or other enticements for a copy of the software described in the article or information about other projects.

THE BELLATOPE

by Ken Lovelett

Ken Lovelett is a theorist, composer and performer working primarily with the broad range of pitched and unpitched percussion in both jazz and classical formats. In addition, he heads up the percussion instrument manufacturing firm Protocussion. *For the past fifteen years he has been developing the Bellatope, a sculptural collage made up of conventional instruments, found objects, and unique pieces he has built. This remarkable assemblage enables him to perform as a one man percussion ensemble (with some string and wind sounds as well). The name derives from words meaning "bell-tree" or "grove of bells."*

Photo: Richard Abarno

I started constructing the Bellatope in 1969. It started out with a conga drum and hi-hat. I used to perform with acoustic guitar groups who did not really need or want a drummer. When I performed with these groups, being a drummer and percussionist, I wanted to use all four of my limbs, arms and legs, so I made a small bass drum to go with the conga drum and hi-hat. As time progressed I added assorted wood blocks, cow bells and triangles, as well as other conventional percussion instruments. Soon I had collected so many percussion instruments that I decided to make metal trees from half inch aluminum bars to hold them. The metal trees were constructed so that they might be taken down, transported and set back up.

When I had started to perform with jazz groups as well as dance groups, I needed more "new sounds". After a while I was developing new instruments, and with this came new and varied techniques in playing these instruments. I cultivated unconventional effects, such as rapid rolls and paradiddles incorporating two or more sound sources of different timbres, or the use of maracas, sleighbells and other sounding things as beaters with which to strike drumheads. I explored a kind of acoustic additive synthesis, combining sounds from different sources in search of new timbral effects. I also worked with performance arrangements in which specific groups of people played along the outside perimeter of the bellatope while I was playing from within. As I progressed I started doing movie sound tracks, albums, and concerts with the bellatope.

The overall arrangement of the bellatope is derived from the shape of an amphitheater. The larger and more massive instruments are located above and behind the bellatope to create a semi-solid background, and help reflect the sound.

Over the years I have experimented with electronic effects on the bellatope. I put transducers, pick-ups and microphones on the instruments and send the signal through phase shifters, digital echo, etc. I put my speakers about fifteen feet apart, leaving the bellatope in the center. I turn the volume of the effects up only equal to the acoustical volume of the bellatope. The result is a whole, beautiful-sounding orchestra of timbre. You have the effects coming through the speakers, while the acoustic sound of the bellatope comes from the center.

Since I have also done a lot of theatrical work I take into account both the light surrounding the instrument as well as the choreographic possibilities realized through the performer or performers.

If anyone would like more information on the bellatope, or on my percussion manufacturing company **Protocussion**, please call or write to Ken Lovelett, P.O. Box 65, Mt. Tremper, New York 12457, (914)688-7620.

MECHANICAL INSTRUMENTS:

History of an Obsession

By Penelope Mathiesen

Portions of this text previously appeared in Penelope Mathiesen's article, "Jacques de Vaucanson's Mechanical Flute Player," in **Continuo: the Magazine of Old Music** (December 1992): 6–8. Reproduced with the permission of the publisher.

INTRODUCTION

Mechanical instruments spring from the desire to produce music without the need for skill or training, either in the absence of professional performers or simply for personal enjoyment. The tradition of mechanical or automatic instruments extends at least as far back as Apollonius of Perga (3rd century B.C.), credited with devising automatons such as singing birds operated by a water wheel or windmill that pumped air into a whistle.[1] Among the earliest extant examples of mechanical instruments are medieval carillons and Renaissance astronomical clocks. Barrel organs, barrel spinets, and flute clocks survive from the 17th and 18th centuries; musical boxes and orchestrions from the 19th century; and player pianos from the 20th century. Though the manufacture of automatic instruments declined after 1930 due to competition from the phonograph, they are still being built today.[2]

The actual production of mechanical music has usually required that "some form of continuous rotary motion must be accurately converted into the momentary movements needed for sounding each note." The classic device was the pinned cylinder, followed in the 19th century by punched cards or perforated paper rolls.[3] Long associated with the history of clockwork and craftsmanship, mechanical instruments were the product of constant experimentation. Success was ephemeral; each creation experienced a wave of popularity followed by an ebb in fortune. Development accelerated – and, some believe, quality declined – with the advent of 19th-century production techniques. According to Arthur W. J. G. Ord-Hume, a prolific writer on mechanical instruments, "Here, in the glory of the closing decades of the twentieth century, we no longer build things that are beautiful or make things just for the satisfaction of practising real craftsmanship.... If today there are those who believe Earth to be another planet's Hell, it has been going that way since at least 1835."[4]

In the 18th century, mechanical instruments were largely the province of royalty and the well-to-do, who attended public exhibitions or "cabinets" that displayed these marvelous inventions. A solid grounding in the acoustics of sound production, the mechanics of instrument building, and the intricacies of music theory was required, particularly for inventors of musical automata such as Jacques de Vaucanson (1709–82). Due to the high level of skill and craftsmanship, musical boxes, flute clocks, and orchestrions captured compositions and performance traditions that would otherwise be lost. Mechanical instruments inspired original works by famous composers from J. S. Bach to Igor Stravinsky, and they preserve for posterity the live performances of Claude Debussy, Gustave Mahler, Maurice Ravel, and others.

From the 19th century onward, mechanical instruments formed a vital part of home music making and popular entertainment. Drawing on a combination of aural and visual appeal, they presented versions of classical, sacred, and popular music to a wide audience. For many people, this was their primary experience with musical performance. Before the development of the phonograph in the late 19th century, street barrel organs may have been responsible for 85 percent of the music heard by the average English urban dweller. Even in the 20th century, childhood recollections of instrumental music may hark back to a musical box.[5]

Originally, the term *mechanical instruments* described self-playing instruments activated by a spring, crank, weights, or some form of clockwork. The term *automatic instruments* referred to all self-playing instruments and extended to those with expressive capabilities, such as orchestrions, player organs, and reproducing pianos. Power could be supplied by the same means used by mechanical instruments, with the addition of electricity. Today, the phrases *mechanical instruments* and *automatic instruments* are often used synonymously.[6] *Automata*, or *androids*, generally refer to mechanical figures – doll, human, or animal – that play a musical instrument or perform other activities, but an *automaton* may also be any mechanically operated instrument.[7]

Besides automata, categories of mechanical instruments include carillons and chimes, clocks, musical boxes, orchestrions, organs, pianos, and string and wind instruments. Among the variations are the barrel organ, barrel piano, bird organ (or serinette), claviorgan, cornettino, fairground (or band or carousel) organ, flute (or organ) clock, flutina, musical box (both cylinder and disc), orchestrelle, organette, pianino, player organ, player piano (or pianola), reproducing organ (or piano), slide flute (or Swanee whistle), street organ, musical photo album, violina, and others. Although mechanical instruments can be found in the music of cultures around the world, this article will discuss the European tradition, including the barrel organ, automata, orchestrion, musical box, and player piano. The footnotes provide further reading.

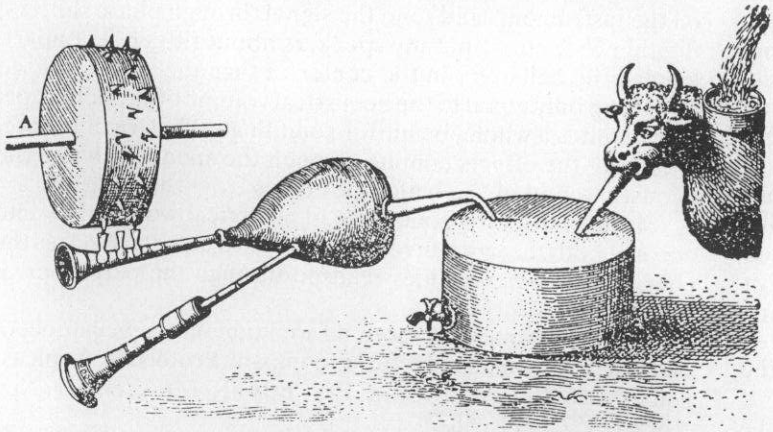
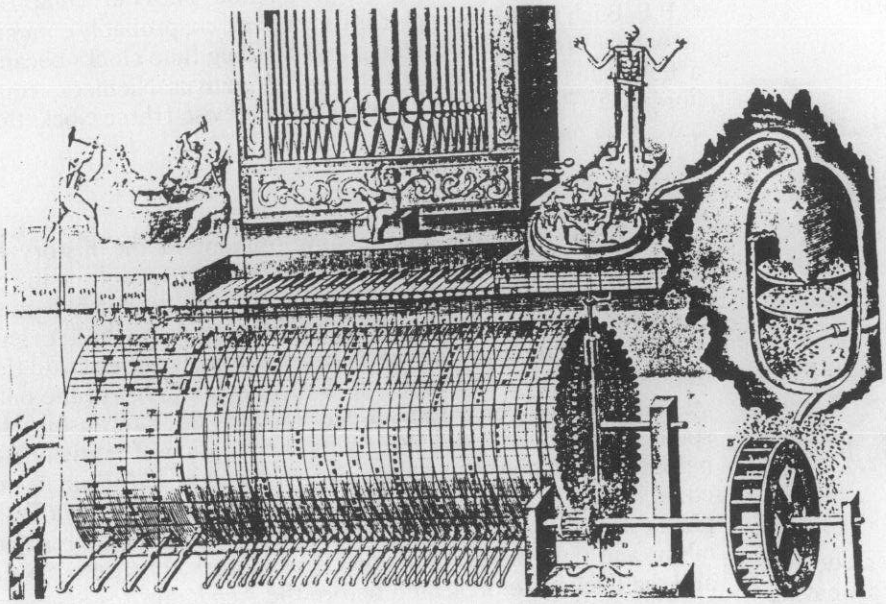


Figure 1. Water driven bagpipes, from Robert Fludd's **De Naturae Simia** (Oppenheim, 1618).

Figure 2.Athanasius Kircher's interpretation of the water-powered organ at the Villa d'Este, Tivoli, built in 1549, from **Musurgia Universalis** (Rome, 1650).



ORIGINS

Little recorded information about the development of mechanical instruments exists before the early 16th century. Experimental philosophers who wrote on the subject include Robert Fludd (or de Fluctibus; 1574–1637) in *De Naturae Simia* (Oppenheim, 1618), which contains exquisite though probably impracticable designs [Fig. 1]. His work was copied and expanded by Caspar Schott (1608–1666) in *Technica Curiosa* (Nuremberg, 1664) and Athanasius Kircher (1601–1680) in *Musurgia Universalis* (Rome, 1650).

Water-powered organs were immensely popular; a famous one at the Villa d'Este at Tivoli, built in 1549, is depicted by Kircher [Fig. 2], though his illustration, based on an earlier drawing, may be somewhat fanciful. Such organs operated from the pressure of a continuous stream of water onto a water-wheel. As the wheel turned, connecting rods from a crank pumped bellows to produce compressed air that drove a pinned barrel assembly through gearing.

Two important mid-18th century works on the construction of mechanical or self-acting organs formed the basis for the subsequent rapid development of mechanical instruments. These were Marie Dominique Joseph Engramelle's *La Tonotechnie ou l'Art de Noter les Cylindres* (Paris, 1775) and Dom François Bedos de Celles's *L'Art de Facteur d'Orgues* (Paris, 1778).[8] Engramelle's treatise, which describes in detail the art of pinning the cylinder, shows that theoreticians and builders were very conscious of the impulse to preserve sound. He suggests "that the works of the great composers, played by great masters, should be preserved with the help of mechanical musical instruments."[9]

The frontispiece to Engramelle's treatise [Fig. 3] shows an 18th-century workshop for the construction of mechanical instruments. In the foreground is the open case of a keyboard instrument. A crank and other parts lie on the floor. Two workers sit at a table, occupied respectively with a barrel and a bird organ. A large automatic flute player on a pedestal – similar to the one constructed by Vaucanson – looms in the background; to the left rear is a tall chiming clock with tools hanging beneath; at the center rear is a rank of organ pipes.

BARREL ORGAN

The English domestic and church barrel organ, extending as far back as 1700, had a horizontal barrel of wood that, except in the larger instruments, was turned by a handle that simultaneously worked the bellows placed underneath. The barrel was marked around its circumference with lines for each note, which were regularly spaced to align with a row of hook-like metal levers attached to a fixed frame. The levers actuated the pallets that admitted air to the pipes. Pins (or, for longer notes, bridges of flat brass wire), were inserted into the marked lines. Each pin was placed to trip the corresponding lever at the proper moment as the barrel rotated.[10]

Most of these instruments had a single major scale with perhaps one or two accidentals. There were several options for changing tunes. Shorter tunes simply followed one another on the barrel. In other cases, the marked lines for one tune were spaced out to provide for pinning other tunes between; to change tunes, the barrel was shifted slightly to move a new set of pins

Figure 3. The frontispiece to Marie Dominique Joseph Engramelle's **La Tonotechnie ou l'Art de Noter les Cylindres** (Paris, 1778).

into alignment. Most organs had at least three alternate barrels. In church barrel organs, the sound was filled out with additional ranks of pipes that sounded at the octave, twelfth, or fifteenth. Domestic instruments sometimes had a percussion section – drum, cymbals, and triangle – that was operated through extra pins in the barrel. Common tunes on the barrels included "Old Hundredth," "Evening Hymn" (Tallis's Canon), "Hanover" (often listed on the barrel as "Old 104th"), "Portuguese Hymn" ("Adeste fideles"), and "Rule, Britannia."[11]

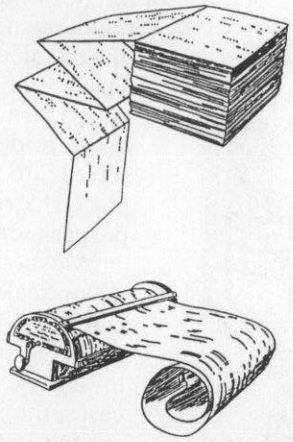


Figure 4. Example of perforated cards and perforated paper roll, from Alexander Buchner's **Mechanical Musical Instruments** (London: Batchworth Press, 1959).

From the 1840s, the barrel mechanism was superseded by the *punched-card principle*, based on the Jacquard weaving loom. A "book" of cards (resembling zigzag folds) or a perforated paper roll was fed in by continuous movement. [Fig.4] If the mechanism was "with keys," levers entered a pattern of holes in the cards and controlled the admission of air to the pipes. The levers were pushed out by the hole as the card moved down and the next card took its place. If "keyless," the entire action was pneumatic. Air was drawn through the holes that matched those in a fixed "comb." The air operated small bellows that opened the pallets under the pipes. Fair ground organs, which operated on the punched-card principle, were visual delights, with rich ornaments, colorful paint, a percussion box on each side, and figures striking little bells while lights blazed. They are still sometimes used for merry-go-rounds at fairs.[12]

Variations based on the principle of the barrel organ included *bird organs*, *street organs, barrel pianos*, and *flute clocks*. *Bird organs*, hand-turned and played on the lap, produced high-pitched tunes designed to encourage caged birds to sing. They were in use until the mid-19th century. *Street organs* – small, portable hand-turned pipe organs suspended from a strap around the neck or balanced on one leg – were built by Italians residing in northern cities such as Paris or Berlin. *Barrel pianos*, made in Italy from the late 18th century, were turned by a handle and resembled an upright piano on a two-wheeled cart. They were played until 1922, when Mussolini, "for the dignity of the nation," put an end to Italian street music. Portable models were also made in England. Barrel pianos with powerful clockwork motors were later installed in dance halls and amusement arcades.[13]

Flute or *organ clocks*, popular in the 18th and 19th centuries, kept the customers of inns, hairdressers, and other places amused.[14] They were sometimes but not always part of a clock with face and hands and ranged in size from small table-top models to large free-standing pieces of furniture. The mechanism consisted of a row of tuned wooden pipes, bellows, and a clock mechanism that set in motion the bellows and a pinned cylinder at regular intervals. The wind from the bellows produced a sound in the pipes similar to the "flute" stop on an organ.[15] Flute clocks played overtures, operatic airs, movements from flute concertos and sonatas, marches, and dances. They were also a favorite gift of royalty. The court of Frederick the Great – himself a flutist – and his successors became a center of musical clock production. The court composer C.P.E. Bach wrote many pieces for flute clock, probably commissioned by Frederick. Designing and building flute clocks became a hobby for certain court officials. Primitivus Niemecz, court librarian to Prince Esterhazy of Hungary, devised three clocks that have been preserved.[16]

AUTOMATA

Probably the most unique development in the history of mechanical instruments was the phenomenon of automata, or figures that played music on actual instruments. Such figures existed at all periods, but were particularly popular in the 18th and early 19th centuries. Great care was often taken to replicate the details of sound production and life-like action. One of the outstanding builders of automata was Jacques de Vaucanson. He spent some time experimenting with the creation of artificial life before abandoning everything else to develop automata "that could excite public curiosity." He produced three pieces: a flute player who "played a real flute controlled by lips and fingers," a tabor- and pipe-player, and a mechanical duck. The flute player and the duck were presented before the Académie des Sciences

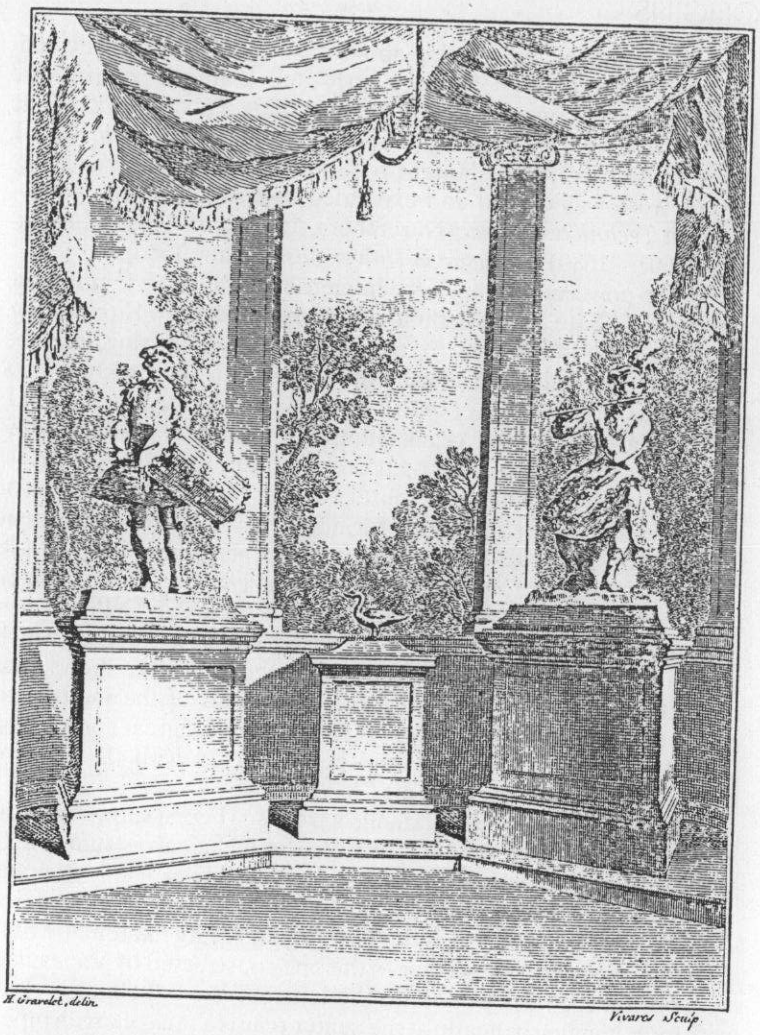


Figure 5. Automaton figures by Jacques de Vaucanson: pipe- and tabor-player, duck, and flute player. From Vaucanson's **An Account of the Mechanism of an Automaton or Image Playing on the German-Flute** ... (London: T. Parker, 1742).

in Paris in 1738; the other device in 1741.[17] [Fig. 5]

Of the three, the duck attracted the most attention. Quoting from Vaucanson's own description, the device depicted "an artificial DUCK, eating, drinking, macerating the Food, and voiding Excrements, pluming her Wings, picking her Feathers, and performing several Operations in Imitation of a living Duck."[18] The idea was not original with Vaucanson; almost fifty years earlier, the Compte Julien de Gennes (1652–1704) had built a mechanical peacock that could walk and digest its food.[19] Vaucanson's tabor- and pipe-player stood upright on a pedestal, dressed like a dancing shepherd. It performed twenty tunes, minuets, rigadoons, and country dances.[20]

In the 18th and 19th centuries, builders of automata turned their talent to financial gain by establishing museums, mounting exhibitions, or taking their pieces on tour.[21] Vaucanson had envisioned the mechanical flute player as something that would attract attention and thus provide the money to finish other moving figures already underway. He built it with borrowed funds and exhibited it in Paris to great success. According to a contemporary account in the *Mercure de France*, for two months in 1738, visitors assembled at the Hôtel de Longueville to view "the representation in wood of a lifesized faun, raised on a pedestal.... The outside is painted the colour of white marble. This figure is seated in a simple, appropriate pose, and arranged as it would be in order to play the flute. In a word, it is an exact and very well rendered copy of the faun executed in marble by the famous sculptor Coyzevaux (which is displayed at the end of the great terrace of the Tuillerie Gardens), with the sole difference that the copy we are discussing actually and very realistically plays the flute."[22]

Vaucanson was probably the first person to analyze the mechanics of sound production on the transverse flute.[23] His little treatise on his mechanical figures, published in Paris in 1738 and in London in 1742, effectively portrays the special expressive qualities of the eighteenth-century flute from the standpoint of a contemporary observer. He begins by comparing the German flute to "other Wind-Instruments, such as the common Flute, the Flageolet, and the Organ-Pipe." These instruments introduce the wind through a fixed opening, whereas "in the *German-Flute* the mouth is undetermined, because in that Instrument the Wind passes through a greater or smaller Issue, made by the greater or less Opening of the Lips, as they approach towards, or recede from each other; as they come nearer to, or are further from the Hole of the Flute; or as they advance more or less over the said Hole. All these Differences ... make it, in playing upon it, capable of a very great Number of Perfections, which are wanting in other Wind-Instruments."[24]

He next discusses the acoustical characteristics of sound production on the flute, such as the use of overblowing to produce a sound an octave higher: "the Position of the Fingers and the Opening of the Holes is the same as in the First. You must blow with a double Force to produce double the Number of Vibrations in the same Time; which makes the second Octave." For the third octave, more than simple overblowing is required: "we must be forced to open several Holes in the lower Part of the Flute; thus the Pipe being more open, the Vibrations will have a greater Issue and a full and open Sound will be form'd, without being oblig'd to give the Wind quite a triple Force." He goes on to discuss the concept of breath support: "The greater or less Force of the Wind depends, first, upon the greater or less Pressure of the Muscles of the Breast, which drive it out of its Receptacle: secondly, upon the greater or less Opening of the lips at its going out."[25]

Reiterating the difference between the German flute and fixed-embouchure wind instruments, Vaucanson says "the Advantages that arise from it, are that the Wind may be modulated by the greater or less Opening of the Lips, and by their different Position upon the Hole of the Flute, and by the Performer's being able to turn the Flute inwards or outwards. By this Means the Sounds may be swell'd and diminish'd, soften'd, and strengthen'd, produce Echoes, and give Grace and Expression to the Tunes that are play'd; which Advantages are not to be found in those Instruments whose Mouth is determined."[26]

Based on his analysis of the physical phenomena, Vaucanson then describes an automaton that would produce the same effects mechanically. The figure was about six-and-a-half feet high, seated upon a piece of rock, placed on a square pedestal four-and-a-half feet high and three-and-a-half feet wide. The mechanism consisted of wheels, weights, axles, chains, cranks, strings, bellows, and pipes. Three pipes ended in small receptacles in the figure's chest. Here they united into one, which went up through the throat and made a cavity in the mouth terminated by two lips that bore upon the hole of the flute. Lever mechanisms regulated the opening and closing of the lips and operated a little movable tongue that opened and shut off the passage of air to the lips. Chains of steel led to the fingers. The construction imitated the joints of the human body so that when the chains were drawn, the fingers rose. The end of each finger was covered with skin or leather, emulating the natural softness of human flesh, to fully stop the holes.[27]

A barrel mechanism regulated the musical numbers: "the Quickness and Slowness of different Airs have been measur'd upon the Barrel, by Means of a Lever ... whose Point mark'd the Barrel, and the Distances between the Points prick'd on were the true Measure for the Tunes to be mark'd. Then the Intervals were sub-divided into as many Parts as the Measure had Times or Bars." The automaton could perform twelve different tunes.[28] According to a contemporary account in the *Mercure de France*, "The *doubles* (ornamental variations), so alluring when played on this instrument, are not forgotten, and the whole playing has swells, diminutions and even suitable holdings of notes, in the most perfect taste.... By means of a crank one can wind the cylinder continuously or stop it and voluntarily suspend its effect at the end of each *air*."[29]

Of the three machines, the tabor- and pipe-player made perhaps the greatest demands on Vaucanson's mechanical genius. As was characteristic of this traditional instrumental combination, the figure managed the pipe with one hand, while the other held a stick that struck the tabor, making single and double strokes and rolls in time with the pipe.[30] Vaucanson compresses the complexities of this mechanical marvel into a few tantalizing paragraphs. One wishes his machines had survived to be judged on their own merits.

London museums of automata that contained musical figures included those of Signor Gagliardi off the Haymarket (1836–37), with 200 figures, some musical; the Maskelynes in Piccadilly (1880s), featuring mechanical cornet and euphonium players (Jasper Maskelyne proclaimed the sounds to be lifelike and "actually made by the instruments"); John Joseph Merlin's museum in Princes Street (ca. 1783), with musical automata and a barrel harpsichord that played seven tunes, and James Cox's museum (1772–75).[31]

Cox, a London mechanic, silversmith, and watchmaker, had built a particularly elaborate set of automata with the idea of selling them to Indian rajahs and princes, but famine and unrest in the East destroyed his market. Instead, he leased the Great Room in Spring Garden, London, and set up his wares as a museum. His most famous piece was the silver swan, famed for

its ability to move its fully-articulated neck in every direction, and which bore a striking resemblance to Vaucanson's duck.[32] It occasionally stooped to pluck a fish from the water, which was "simulated by rotating twisted glass rods, while a carillon driven by clockwork played one of several tunes."[33]

The father and son, Pierre (1721–90) and Henri-Louis (1753–91) Jaquet-Droz achieved world fame with three wonderful mechanical figures: "The Designer," "The Young Writer," and "The Clavecin Player," all of them preserved in the Neuchâtel Museum. The musical example among the three, "The Clavecin Player," shows a young woman seated at a small keyboard instrument. A system of levers similar to that of Vaucanson's mechanical flute player produced the effects of trunk, head, hand, and eye movement. As she played, the young woman's bosom rose and fell, her hands moved over the keyboard, she bent closer to her music as if to see it more clearly, and she acknowledged the audience with a polite bow at the end of each piece. The most intricate of all the Jaquet-Droz automata, "The Grotto," was brought to Spain by Pierre in 1758 at the invitation of the King.[34] This fantastic construction of fountains, singing birds, and animals against a mountain backdrop complete with a rising and setting sun was taken by the Inquisition to be a demonstration of witchcraft and almost cost Jaquet-Droz his life.[35]

ORCHESTRION

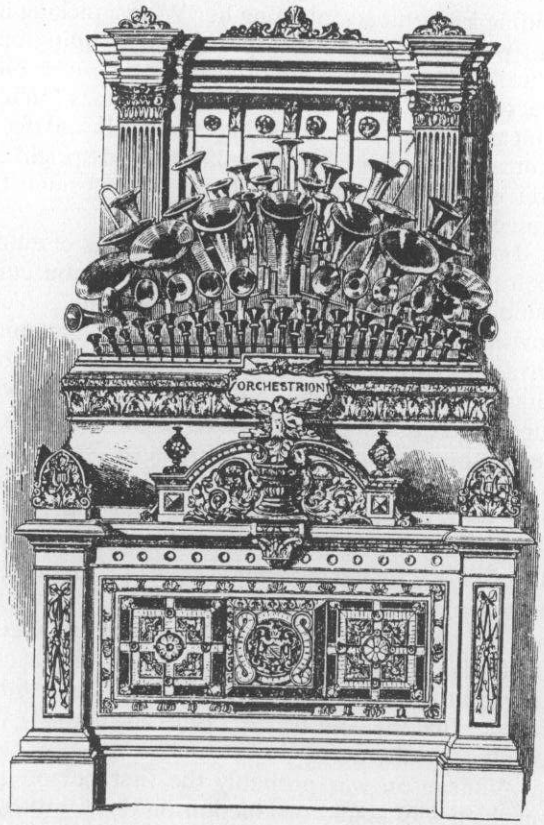
Orchestrions, or mechanical orchestras, originated in Germany in the late 18th century. These large barrel organs with pipes and percussion, driven by weights, sometimes imitated the orchestra visually with automata playing violins and other instruments.[36] Orchestrions developed in response to advances in organ building techniques, new discoveries in acoustics, and changes in musical taste. The almost monotonous precision of previous mechanical instruments resulted in a lack of musical expression that no longer suited the temperament of the times. Builders sought relief in more faithful imitations of real musical instruments and even entire ensembles. Among the best makers of orchestrions were the Maelzel brothers of Vienna and the Kaufmann family of Dresden, who in a way continued the work of Vaucanson and others.[37] The Kaufmanns were particularly successful in developing and presenting mechanical instruments to the public. [Fig. 6] They developed an automaton trumpet device that played marches with drum accompaniment (the Belloneon), the Chordaulodion organ, a larger Symphonion, and an even larger mechanical orchestra (the Orchestrion).[38]

Orchestrions played works by such composers as Joseph Haydn, Anton Eberl, W. A. Mozart, Gaspare Spontini, and Ludwig van Beethoven, who wrote *Wellington's Victory* for the Panharmonicon built in Vienna by Leonard Maelzel, brother of J. N. Maelzel, the inventor of the metronome.[39] Maelzel's panharmonicon captivated the public with its unique appearance and new sound effects, including the imitation of winds and strings with all their dynamic shadings.[40] The use of reed stops with variously shaped metal or wood resonators approximated the sounds of the various instruments.[41] Among the individual instruments associated with the orchestrion, the violin (or violina) is perhaps the most impressive. Surviving examples have bridges, strings, and bows that approximate the playing technique of a real instrument. If properly maintained, they play remarkably well in tune and provide visual as well as aural excitement.

MUSICAL BOX

The cylinder musical box is a direct descendant of the mechanical instruments of the 16th–17th centuries.[42] The musical box mechanism evolved in the later 18th century in Switzerland, based on a new principle of miniaturization that allowed small musical movements to be placed in watches and snuff-boxes.[43] Perhaps the most famous makers were the Nicole brothers of Geneva, who established the firm Nicole-Frères (1815–ca. 1903).[44] The expensive and highly prized Swiss musical snuff-boxes were often quite small and lacked the "instant stop" control provided on larger versions. According to the *Musical World* of 1837, a London gentleman seated piously in church accidentally touched the start mechanism of his snuff box, which played its inappropriate repertoire of "Drops of Brandy" and "The Glasses Sparkle on the Board" from beginning to end.[45]

Figure 6. An orchestrion by the Kaufmann family, as depicted in **The Illustrated London News** for July 5, 1851. From Arthur W. J. G. Ord-Hume's **Clockwork Music**. (New York: Crown Publishers, 1973)



The earlier cylinder or later disc type musical box produced sound from the plucking of tuned metal tongues arranged like the teeth of a comb. The *cylinder musical box*, with its superior mechanism, is highly prized today by collectors. A strong clockwork motor turns the brass cylinder. A train of gears turns the fan governor mounted on an endless screw. The tune-change lever moves the cylinder laterally against a spring to bring– for each of 8–12 tunes – a different set of pins in line with the teeth of the comb. The cylinder is pinned with fine wire and each pin is inserted into its hole by a hollow punch. The teeth – small tongues of high-carbon steel – are individually soldered to the comb. Each tooth is pointed to allow for the passage of the pins of other tunes as the cylinder rotates.[46]

Surviving catalogs attest to the wide choice of available music. "Of particular interest to the musical historian are musical box interpretations of works long since forgotten and in some cases lost," especially from the operatic and overture playing boxes of the early years.[47] Later musical boxes, after competition forced the introduction of mass-production techniques, are of less intrinsic musical value. Many degenerated into novelty items such as musical beer mugs and children's musical boxes that played one or two simple tunes.[48]

By the close of the 19th century, the quality of musical boxes had declined and prices were so

cheap that almost everyone could afford one. The boxes that played popular songs every evening after dinner suffered considerable wear and tear; few survive in playing condition. Those that held up the best are the "family musical boxes" used only on Sunday to render appropriate hymns.[49]

The *disc musical box* was invented ca. 1886 almost simultaneously by Ellis Parr in London and Paul Lochmann in Leipzig. They eventually joined forces to produce the Symphonion. Since cylinder music boxes were large, expensive, and cumbersome, a new type that played changeable flat discs was a major advance.[50] In place of a cylinder, there was a metal disc turned by a sprocket that engaged the holes around the periphery of the disc, which was punched on the underside with bent-over projections. Although each disc played only one tune, they could be reproduced in quantity from a master disc, a great savings over the labor required for individually pinning every cylinder. The disc musical box developed into large upright coin-operated models used in bars and dance-halls.[51]

With the advent of the disc machine, the center of the industry shifted from Switzerland to Leipzig and Berlin. The major output was exported to Czarist Russia and Great Britain. High tariffs blocked the U.S. market until 1901, so separate companies were set up: the Polyphon was produced by the Regina Music Box Co. of Rahway, N.J., and the Symphonion was produce by the Symphonion Music Box Co. of Asbury Park, N.J.

Disc musical boxes became ever-larger. The Troubadour made by B. Grosz & Co. of Leipzig (1896) had a repertory of almost one hundred tunes. The Leipzig Music Works produced the seven-foot-tall Monopol Excelsior. The giant Orpheus, made by Ludwig & Co. of Leipzig, stood 86 inches high, 30 inches wide, and 20 inches deep; its discs were 22 5/8 inches in diameter. An 1898 model of the Symphonion stood nine feet high in a carved oak case and included a set of bells. The "largest musical automaton in the World," a model of the Komet made in Leipzig by Weissbach & Co. around 1900, was 11 feet tall and played 33-inch discs.[52]

The decline of the cylinder musical box continued during the 10–15 year boom of the disc version, but "before the new century was more than five years old, it was obvious that the musical box in all its forms was on the slippery slope," according to Ord-Hume. Companies quickly went out of business or turned to other products, such as vacuum cleaners and other domestic appliances. "The 1900s were filled with their own sounds and these did not include those of the musical box."[53]

PLAYER PIANO

The first self-playing pianos, without pneumatic action, were played from a pinned barrel like the barrel organ, operated by either a handle or clockwork.[54] The *player piano*, or pianola, was a pneumatically-operated upright piano. The mechanism, at first placed adjacent to an ordinary piano, was by 1901 incorporated into the instrument itself. [Fig. 7] Holes and slots were punched in a paper roll, which was held on two discs for placement into an opening in the front of the piano. The roll passed over a row of holes in a tracker bar and was hooked onto a take up spool below. As holes in the roll were uncovered, air was drawn through to activate a valve that transferred the suction to a pneumatic bellows, which then collapsed, activating a hammer mechanism.[55]

One development, after 1904, was the recording of live performances of famous pianists, including Sergei Rakhmaninov, Artur Rubenstein, Debussy, and George Gershwin. Many of these rolls, signed by the artists, have been preserved in sound archives such as the Archives of Traditional Music at Indiana University and the International Piano Archives at the University of Maryland. Another trend was the creation of original compositions for player pianos. The possibility of exceeding the limits of 10 fingers and producing chords of 30 or more notes inspired composers including Stravinsky, Paul Hindemith, and others.[56]

The player piano could provide a degree of interaction that was rare in mechanical instruments. Many instruments allowed the rendition to be modified to suit the taste of the player, who produced subtleties of phrasing, tempi, and accentuation through the manipulation of the tempo and volume controls, following indications printed on the rolls. Thus no two renditions were exactly alike, and the operator's skill could improve with each attempt.[57]

Player pianos were immensely popular in America, accounting for 70 percent of the pianos manufactured in 1920 and spawning catalogs of classical and light music rolls, which could even be exchanged at libraries.[58] "Player piano advertising often showed the young man serenading his lady-love by music-roll," according to Ord-Hume. "In its day, the player piano did much to spread interest in music among the ordinary people. That surely must count for a great deal."[59]

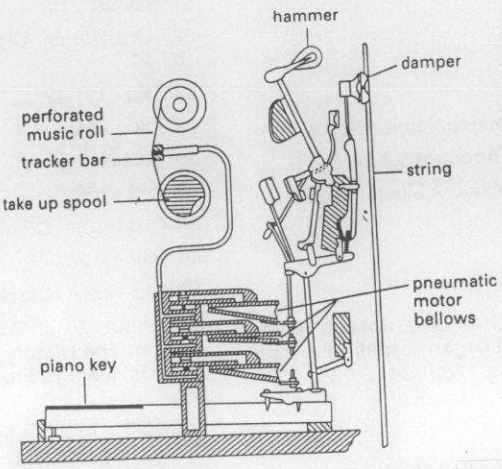


Figure 7. A player-piano action showing the pneumatic operating devices. From Anthony Baines' **The Oxford Companion to Musical Instruments.** (New York: Oxford University Press, 1992)

CONCLUSION

Mechanical instruments represent much more than a nostalgic look backward. Once restored, they sound exactly as they did when originally constructed, as opposed, for example, to the approximation of historical performance practice that is obtained by modern performers using antique instruments. Furthermore, musical boxes, cuckoo clocks, and other items of varying quality are still displayed, manufactured and sold. For example, the retail outlet of the Smithsonian Institution offers fine reproductions of musical boxes from their collection. Contemporary composers continue to write for these instruments. Conlon Nancarrow records his works on his custom-altered 1927 Ampico reproducing piano. Bars and restaurants occasionally feature working collections of mechanical instruments for their patrons' amusement. Those without access to actual models can enjoy them on recordings available from the Musical Heritage Society and elsewhere.

A primary source of information on mechanical instruments is the Musical Box Society International (U.S.A.). Members include collectors and dealers of antique musical boxes, player pianos, orchestrions, band organs, barrel and paper roll organs, clocks and watches with music works, musical automatic dolls and displays, and birds and whistling figures. The organization maintains a library of books and videotapes on mechanically produced music.

Ord-Hume laments the fact that "Today, the average person leaving school seems to leave behind him all desire ever again to touch a serious book, to have to think productively in the arts and sciences, and to create, to write, to experiment." Thankfully, many of us continue to believe, along with him, that "those who collect musical boxes, magic lanterns and stamps, or spend their free time standing waist-deep in a trout stream, climbing mountains, or jumping out of aircraft with a parachute are in truth giving themselves personal pleasure in a manner which should not upset others."[60]

SOURCES FOR FURTHER INFORMATION

Musical Box Society International. Contact Marguerite K. Fabel, Secretary-Treasurer, Musical Box Society International, Rt. 3, Box 205, Morgantown, IN; (812) 988-7545.

The Vestal Press. Recordings, books and reprints relating to mechanical instruments. Vestal Press also produces an annually updated **Vestal Press Resource Catalog** with full information on resources in the field from a wide variety of vendors. 320 N. Jenson Rd., PO Box 97, Vestal NY 13851-0097.

Past articles in EMI: "Computer Control for Acoustic Instruments" in Volume VII #1 (June 1991); reviews of books and recordings of mechanical instruments, in Volume VI #2 (August 1990).

See also the sources cited in the footnotes.

Penelope Mathiesen writes a regular column on early wind instruments for **Continuo: The Magazine of Old Music**. *She can be contacted at: 1800 Valley View Drive, Ellettsville, IN 47429; (812) 876-3592.*

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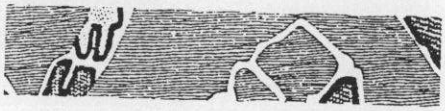
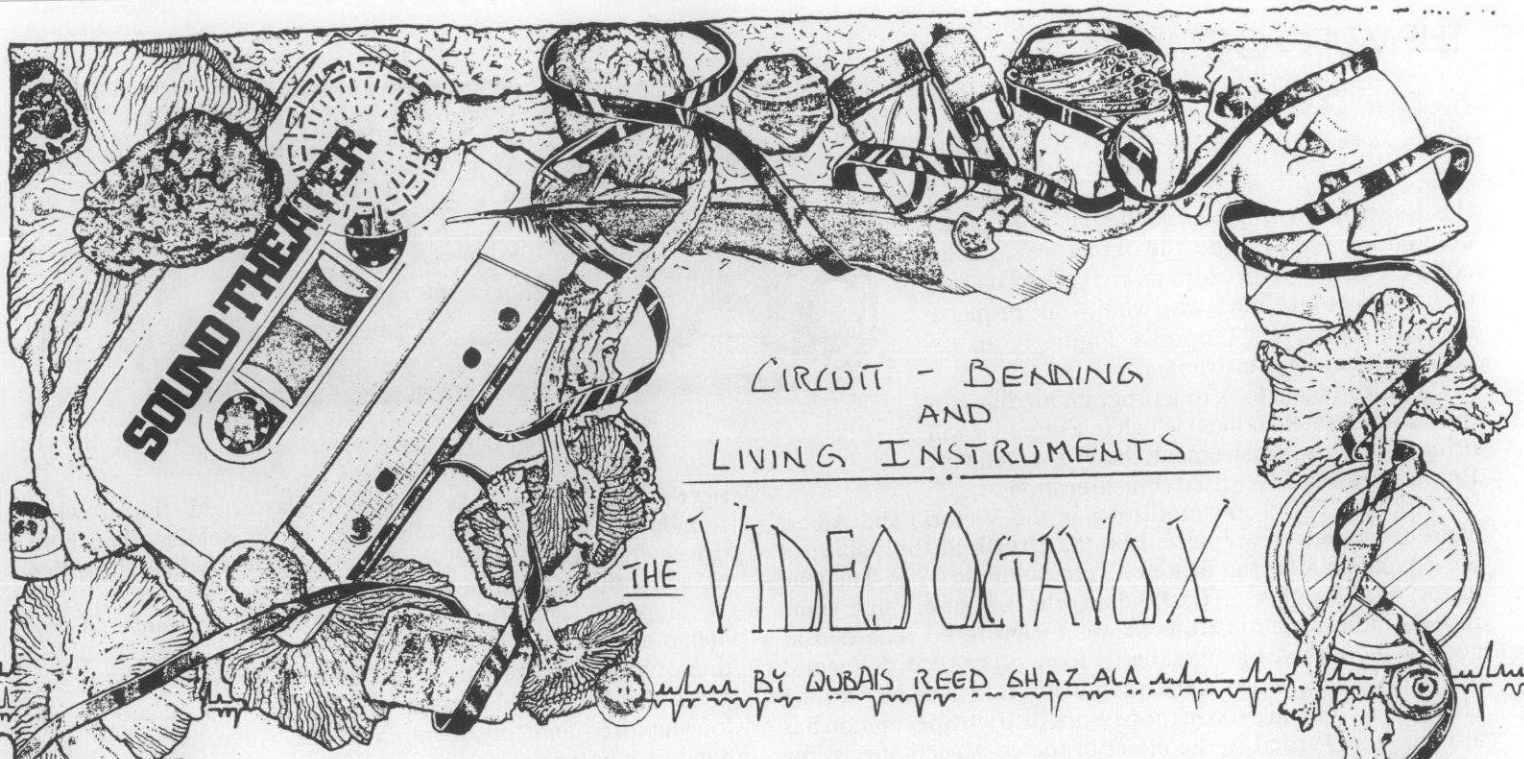




CIRCUIT - BENDING AND LIVING INSTRUMENTS

THE VIDEO OCTAVOX

BY DUBAIS REED GHAZALA

Again, the palace was filled with the terrible sound. Knowing the sultan would be absorbed in his hideous spectacle and would not notice shadows gathering behind the woven lattices, servants collected to watch the sovereign take his ghastly pleasure. Smoky yellow light in the center of the ornate chamber fell over two figures, helpless in their fate as the contest ensued.

Throned in deep cushions was the emperor, the dismal news of battle losses fading in his tired head as he watched the pair before him and was filled with the sound of their violence. A moment frozen in time: The English soldier now lay motionless beneath the great striped beast, his scarlet lapel pierced by the creature's fang as it waited, as all cats will do, for a movement from the prey.

Veiled in shadows behind the sultan, the servants shuddered as the Englishman stiffly raised his arm — is it in defense or supplication? — and cried-out another time, his voice reduced to a rasping whistle. Poised over the soldier's throat, the tiger's massive head shook with horrible empty growls as though instead of any bit of rationale it rather was filled with gasping bellows, rusting machines, and barbaric pipes meant only to terrify... which, of course, is exactly what it did contain.

Tipu Sultan tried his best to ignore the squeaking handle that grew from the animal's shoulder, as well as

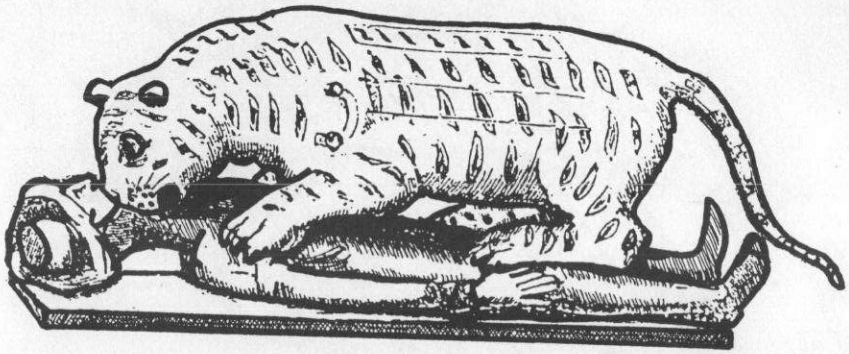
THE VIDEO OCTAVOX

by Q. R. Ghazala

(continued from previous page)

the assistant laboring over its function, all of this commotion aiding little the sculpture's believability. Yes, as you already knew, or guessed along the way due to the otherwise wholly-out-of-place-in-EMI scenario, 'Tippoo's Tiger' is an experimental musical instrument.

Such automata look to a program medium for their sounds (and actions) which in a moment will bring us to my new instrument, the Video Octavox. But first, I know I've raised some questions.



TIPPOO'S TIGER

Tippoo's Tiger, now on display in the Victoria and Albert Museum, London, was seized by the British at the palace of Seringapatam after the death of Tipu Sultan in 1799. The true history of this grotesque East Indian relic is unsure. While some reports indicate the instrument was meant to be regarded as nothing more than a general battle icon, other records suggest that Tippoo's Tiger was built to commemorate the fatal mauling of a British General's son in the Mysore district. Speculation has also been forwarded to the effect of the construction possibly dating some century-and-a-half earlier than Tipu Sultan's death. An article written in 1835 (*The Penny Magazine*, August 15) suggests that the dress of the figure is much more that of a Dutchman of the 17th century, as the Dutch were making incursions in the Southern regions at that time, than of a late 18th century Englishman. The roughness of the design may also indicate fabrication prior to Tipu's 'Khodadad', or Gift of God, as he entitled the lands of his reign.

To this I might add, though I haven't examined the machine myself, that the difference in attitude of the two figures, combined with their crude means of connection (large wood screws protruding from the tiger's feet at the time of the 1835 writing) and the difference in building materials (the man of heavy wood and much more roughly built, the tiger light and more beautifully modeled) would seem to indicate that some enterprising individual, with an eye to the political climate of the day, combined a fanciful organ (the tiger also contains a hidden pipe rank and keyboard) with a common standing figure (the prone soldier is anything but realistic in his position) connecting the soldier's newly installed noise apparatus to the main mechanical drive system of the tiger. The several descriptions I've read beg for this supposition. I can only assume first-hand examination precludes this possibility.

In its prime, Tippoo's Tiger contained two separate pipe and bellows systems. Hidden behind a contoured panel in the tiger's side was an ivory-inlaid eighteen note button-board, each button sounding a pair of like-tuned pipes. The bellows for these were charged by means of a thin cable exiting the beast's shoulder blade and actuated by an assistant. The more renowned function responsible for the shocking sound effects was certainly also the more novel. In this system a crankshaft attached to both a cable and a worm gear is rotated by means of the aforementioned handle. The cable is alternately pulled and released by this shaft, exiting the tiger and entering the soldier's chest where it pumps the small bellows feeding the screaming pipe, as well as attaching to the soldier's hinged arm. While this action is taking place, the worm gear slowly turns an armature sprouting rods whose lengths are designed to lift two heavily-weighted bellows, suddenly releasing them at full capacity causing air to rush through a pair of pipes tuned disagreeably apart, thereby producing the tiger's wicked growl. As the handle is turned, the growl is sounded once for every twelve cries of the soldier, the whole drive system behaving very much like the action behind the antics of the traditional jack-in-the-box.

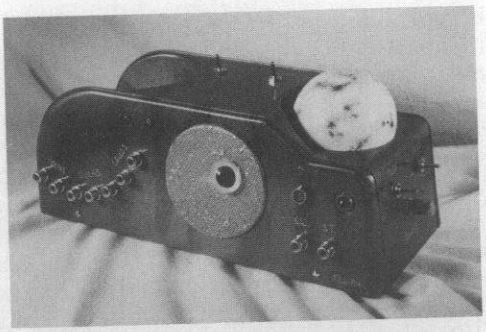
Tippoo's Tiger stands out as one of the most unusual and memorable of musical automata. The earliest detailed description of an automatic musical instrument is found in the *Banu Musa* manuscripts, dating from 890 AD,[1] though more than four-hundred and fifty years earlier St. Augustine wrote of a number of instruments which may have involved such principles. If records were available, and we could freely turn back the centuries, I'm sure we'd find, before the aeolian harp and before wind chimes, curious individuals making such things as drip-drums (bamboo lengths, gourd sections, stone plates, etc. placed under water-drop sources), talking trees (green limbs tensioned against hollow partners to moan as they sway... a prepared forest perhaps?), or any number of envirokinetic musical instruments. And there, under the far cliff's edge, where man has not yet been, brown seed-pods still rattle in the autumn wind.

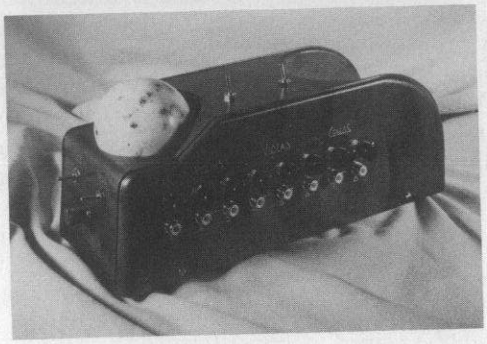
Better-known automatic musical instruments might include the meticulous Bontemps singing birds,[2] or certainly barrel organs and player pianos, music boxes, and musical time-pieces ranging from massive animated clock towers to diminutive wrist and pocket watches. Browsers of antique shops will find the occasional perforated-roll novelty instrument of yesteryear such as small crank-wound devices like the "Rollmonica" or "PLAYASAX" which systematically channel the player's breath to a number of reeds. Found on occasion are small organettes consisting of bellows, reeds, and various actuation devices, again crank-wound. Even a few magnificent orchestrions wait for buyers and repairmen. Within their exquisite cabinets rest the necessary machinery and instruments to produce an incredible assortment of complex orchestrations. Popular in the early 1900s, these occasionally gigantic machines might contain, as did the style K Pipe Organ Orchestra by Wurlitzer (1916), an instrument grouping of piano, violin pipes, (real violins were used in some orchestrions), cornet pipes, cello pipes, vox humana pipes, oboe pipes, doppelflutes treble and bass, bass drum, snare drum, kettle drum or tympana effect, cymbal, orchestra bells, triangle, cowbell, tambourine, steamboat whistle, horse-trot, auto horn, cathedral chimes, xylophone, and doorbell.

1. [From the editor:] The name **Banu Musa** refers to three brothers, prominent in the sciences, who were active in Baghdad in the early 9th century. They constructed an instrument using a revolving cylinder with pegs.

2. [From the editor:] Blaise Bontemps, working in Paris in the latter part of the 19th century, perfected the "Bird Flageolot" mechanism, in which the calls of different birds were recreated by means of a slide-whistle-like mechanism. The air flow and the sliding stopper position were controlled by pivoting levers with one end riding over the crests and valleys of the carefully shaped outer edges of rotating wheels.

Then there is the Hexameter Machine (also billed as the Eureka), displayed near the turn of the century by William Bullock at his Egyptian Hall in London. This device, thirteen years in the making, continually surrounded in mystery and speculations of fraud, was not only capable of producing automatic music, but could also speak in Latin composing hexameter poetry (each line of verse containing six metrical feet), one line per minute, twenty-four hours a day, seven days a week, for ever and ever and ever! Withdrawn from exhibition under pressure to unveil its secrets (and subsequently disappearing), the mechanism behind the machine's remarkable capabilities remains a baffling mystery, a provocative bit of music ephemera.





Upper left: Vidio Octavox, front view, with tentacles detached.
Lower left: Back view, with outputs and level controls.
Right: Vidio Octavox playing chords from changing static patterns on an antique television.

All of these devices depend upon a program medium for their function ... a simple branched armature as in the tiger of Tipu, plus an assortment of the more familiar pinned cylinders, punctured discs, perforated rolls both spooled and endless, and the occasional planchette or ribbon as well. At the heart of the function of each of these there is addressed a continuum (time) punctuated by incidents (pitch events). Once reduced to such general terms it becomes quickly apparent that we are *surrounded* by such media, and the desire to build instruments that create pitch events in response to incidents of our environment is one that myself, and many other musicians immemorial, have been intrigued by. Along these lines, I've thought that just as a player piano roll, with its thousands of perforations, is a two-dimensional representation of a three-dimensional performance, there should exist the counterpart of this to in some way register the stimuli of natural environmental occurrence onto a replayable medium.

Varying intensities of light, their natural rhythms and motion, are strong modifiers for envirokinetic art. The fascinating aspect here is that much of the same action used to trigger installations in the field (illumination changes in atmosphere, assorted transmissive and reflective interferences, etc.) can be recorded with a camera on video tape ... the 3-D environment in which the sensors might be placed to register sunlight through fluttering sycamore leaves, people moving to and fro, moonrise on a rippled pond, or stations tearing past the train, is now captured on a roll as for the player piano, in 2-D, pixels soon replacing perforations.

My automatic instrument, the Video Octavox, in this way uses video tapes as a program medium, which not only opens up the video camera as a multi-channel musical instrument, as will soon be seen, but also turns every video recording in your collection into a surprising experimental music composition. Yes, it works on any video image and, within reason, could provide argument for tuning-in regular cable or broadcast TV. Well, that might be stretching it.

As the name suggests, the Video Octavox is an eight-voice instrument. Each voice is produced by an oscillator whose pitch is determined by the varying resistance of a photo-cell held in position against a video monitor by means of a small suction cup. The range and timbre of the first seven oscillators are that of a string section. Synthesized here are two violins, three violas, and two cellos (both of which can be tuned down to double bass as well). The eighth voice is that of a modified Photon Clarinet, one of my light-controlled instruments which, employing two sensors, plays varying scales of notes across a very wide range. (See EMI, Volume VII #3, March 1993, for a complete description of the Photon Clarinet)

The design of this instrument is prototypical with circuitry held to a bare minimum. Each of the seven string synthesizers has only range, level, and mute controls; the Photon Clarinet section contains the usual voice selection switch, initialize adjustment, and level control. Two fluctuating envelope LEDs, one for the cellos and one for the Photon Clarinet (the former a bright 2000 mcd red, the latter a blue silicon carbide) combine with an antique deep green glass pilot for visual indication. Two speakers with cut-out switches are built-in for audio monitors, one for the strings and the other for the Photon Clarinet.

No mixing circuitry is provided. Better handled outboard, the Video Octavox's eight output signals (seven string voices, one clarinet) appear at separate RCA-style phono jacks on the back of the housing. These feed a mixer where stereo image and equalization (etc.) are finally addressed.

I'm constantly on the look-out for unusual housings to build instruments into. From about the 1930s through the 50s, celluloid, bakelite, and new plastics were in their heyday, quickly replacing woods and metals everywhere. These modern materials gave rise to sensual designs that were embraced strongly in the field of electronics. Radios from the era exemplify this direction in technology; collectors today easily spending $1,000+ for certain receivers, small table-top models, due to their fanciful use of a swirled composite substance known as catalin.

White bakelite, a somewhat brittle early plastic, forms the case of the Video Octavox. It had been an early telephone handset amplifier, and I was immediately drawn to it at the thrift shop, its lines reminding me of a stylized squid or octopus body. In homage to light, the instrument's player, composer, and implicit

creator, a glowing florescent model of the Sun is sunken into the top of the case, surrounded by minuscule footlights 1/32" in diameter. A matching glass eye peers from the golden speaker grille; gold also coats the seventeen RCA jacks emerging from the case. All control titles are hand-written in gold as well. The new finish of this old housing is in deep sea-creature-shades of metallic greens, blues, and purples blended together with black fishscale accents, all glistening under a thick final gloss. Coil-cord photo-sensor tentacles add to the organic effect, and to see the instrument atop a video monitor with suction-cups gripping the glass makes quick the notion that one is in the presence of a mysterious otherworldly parasite thriving upon each flicker from the screen.

It is generally true that common video images are most active toward their center. The action then tends to progressively decrease as the outer edges of the image are approached. This activity gradation could suggest a placement of the Video Octavox photo-sensors to produce a traditional ensemble response ... an articulated lead voice supported by a backing accompaniment.

Suppose the two sensors of the Photon Clarinet section are centrally attached to the monitor, where the image is most active. These sensors will produce the lead voice, one sweeping the pitch while determining the range and scale divisions of the other, which itself creates melodies and cadenzas across its changing frequency sets. The two cello sensors might be placed somewhere between the Photon Clarinet sensors and the screen's edge, in an area of intermediate activity. And finally, the five remaining violin and viola sensors could be placed further toward the outer boundaries of the monitor's image.

You can now begin to imagine the type of music this sensor configuration will create. The string section drifts between tone clusters, the cellos more active underscoring the bass. On top of this, rifling abstractly, notes falling upon a staff blown in the wind, the Photon Clarinet sings in impossible figures, strange passages swirling like dust in the sun.

Think for a moment about the similarities between composing music and cinematic (or video) sequences. The sonata form, within certain limitation, could be compared to a chase scenario. Or any other sequence of alternating perspectives central to an action progressively developed and combined to conclusion. For example, each of the following scenes would be interpreted differently by the Video Octavox. (The instrument's eight outputs are now running through a mixer, tones enhanced, touch of reverb, stereo image of cellos left and right, Photon Clarinet center, violas then violins panned out across the field).

Scene 1: Distant aerial view. Empty wasteland sweeping slowly by far below. A faint trail of dust following a tiny black rectangle. Here the seven strings hold their chord, small fluctuations in pitch relative to moving landscape details. The clarinet voice is also steady, maybe bending or changing a note if the dust intercedes.

Scene 2: Sharp close-up of bandit's face, racing full-gallop. The background flies by soft and out of focus. Now the two violins and three violas, whose sensors toward the edges of the screen are registering the sweeps in brightness of out-of-focus scenery, begin in quick portamento to alter their frequencies. The two cello sensors at the edges of the outlaw's face cause the pitch of these voices to sharply rise and fall as bright background and darker foreground alternate. With sensors upon the desperado's bobbing facial features, the clarinet breaks into a distinct pattern of notes and scale shifts.

Scene 3: Tight shot of stagecoach careening down the trail. Sharp focus throughout as scenery speeds by. Clarinet note patterning shifts, cello passages decrease in range and activity, but now the violins and violas, with abrupt rather than soft changes in brightness upon their outer-edge sensors, leap into a complex chorus of staccato variations.

Once these 'audible scenes' are visualized, it becomes easy to imagine the musical piece that would develop from these shots progressing, back and forth from one to the next, with the variance of additional camera angles and sequences that might be included. Perhaps a broken axle will separate drivers and team from the stagecoach which, filled with rifles, gold, and whiskey, lunges over the cliff, tumbling in slow motion toward the sparkling water far below. A shot now of the wooden coach smashing to the lake, foam flying and waves settling back to serenity, would nicely conclude both the chase sequence and the Video Octavox composition (as also would someone tripping over the power cord).

Of course, in addition to creating music from oblivious video sources, video sequences can be filmed or constructed with musical production in mind. The video camera, as I mentioned earlier, is now a musical instrument, video tape an addressable program media for automatic composition. Very briefly, I'll touch upon a couple obvious possibilities...

First, as soon as operators become familiar with the Video Octavox responses they will be able to 'hear' visual scenes around them through the instrument's musical suction-cup eyes. Any single scene in the viewfinder contains information for various sound productions since the Octavox sensors can be placed anywhere on the monitor. In this way, a sequence of 'found-scenes' can be recorded to create a complete experimental composition.

Second, scenes can be choreographed for the camera, (and therefore the Video Octavox), allowing greater control over the entire process. In this way a stage production could be 'reflectivity-zoned' so that participants, relative to stage position and activity, could control individual instrument voices. In the most basic form, each Octavox voice sensor would be attached to the video monitor corresponding to an actor's position before the camera. If each performer held a circular white card whose reflectivity could be adjusted by angle of incidence, all eight voices could be precisely controlled. Mirrored sheets, strobe lights, projected images, reflective costumes, etc. etc. could all be incorporated in the production.

I should also note that in any mode of operation the output of the Video Octavox can be directly dubbed onto its source tape, fully synchronized with the action, thereby becoming the new soundtrack. You can imagine the possibilities.

The Video Octavox, in its present configuration, is an extremely basic instrument. Elaborations upon the principle would surely include greater voice control ... perhaps selectable wave-forms for each oscillator along with additional sensors for filtering and envelope shaping. Further oscillators, percussion effects, and a degree of on-board mixing would also be nice.

Discordance is not objectionable to me. I actually relish its richness in many cases. Still, circuitry exists to quantize the pitches thereby producing music much more listenable to most ears, though, to my mind, this would destroy the fascination of the instrument along with its distinct musical personality.

The Video Octavox is my Tippoo's Tiger; however, instead of celebrating the conquest of an enemy it champions the opposite a camaraderie of disparate forces, a focus upon creation rather than destruction. As surely as I'm deeply moved by the artworks of my species, I cannot resist the astounding chaos of nature which absorbs me by means of its sheer power and the elegance of its spontaneous compositions. I'm attracted to the idea of musical instruments that are endowed with their own 'table of elements' (sound sources) and a means of catalyzing these into musical forms. Though my Video Octavox is but a small step in such directions, perhaps it will still demonstrate to the reader a few possibilities within the realm of photo-audio

constructions and their usage in the creation of automatic music.

Our world is full of new music waiting to happen, waiting to escape the cages that hold it back. If the Video Octavox is nothing else, it is at least a key to one of these cages, and all such keys, yours and mine, are precious. These keys, simple as they might be, all fit the same complex lock ...the lock that closes the chain stubbornly binding the future to the past.

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Mechanical Toys by Charles Bartholomew, Chartwell Books Inc., NJ

Musical Instruments of the World by the Diagram Group, Facts On File Publications, NY

The author will accept commissions to construct any of his devices covered in EMI, circuit-bent or original, although availability of specific electronics for bending is often uncertain. Contact Q.R. Ghazala at Sound Theater, ECHO 241,7672 Montgomery Rd., Cincinnati, Ohio 45236.

NOTICES

Sound Symposium 7 — nine days and nights in which to listen, explore and discover the world of sound — takes place July 15-23, 1994 at St. John's, Newfoundland. A host of sound art people, both traditional and contemporary, will be attending, communicating and performing. For information contact Sound Symposium, c/o 81 Circular Road, St. Johns, Newfoundland A1C 2Z5, or phone (709) 737-8210. [9-4]

AIR COLUMNS AND TONEHOLES: PRINCIPLES OF WIND INSTRUMENT DESIGN is a spiral-bound booklet containing the four articles on practical wind instrument acoustics by Bart Hopkin that appeared in EMI in 1992 and 1993. The articles have been much revised and improved, and there are several additional features included. Published by Tai Hei Shakuhachi; available for $12.50 (no additional postage required) from Tai Hei Shakuhachi, PO Box 294-C, Willits, CA 95490, or from EMI, Box 784, Nicasio, CA 94946. [9-4]

The CompuServe Information Service will offer a month-long focus on making musical instruments this September and we invite anyone who is interested to join us. Exchange messages with instrument builders from around the world, participate in real-time conferences, download files from the library, and view images of musical instruments built by other participants. CompuServe is a telecommunications service (computer bulletin board system) that you access with your computer and modem. The September activities will be held in the Focus section (13) of the CRAFTS forum (GO CRAFTS) but be sure to drop into the woodworking section (11) to say hello and join the fun. For an introductory sign-up package with one month free basic services and a $15 usage credit, call 1-800-848-8199 and ask for rep. 304. [9-4]

Complete or partial sets of proceedings (conference program, keynote addresses, paper presentations, transcripts of panel sessions) from last summer's Tuning of the World Conference at Banff are available from Office of the Registrar, Banff Centre for the Arts, Box 1020, Banff, Alberta, Canada, T0L 0C0, phone (403) 762-6180. Call or write for information.[9-4]

The Samchillian Tip Tip Tip Cheeepeeee is a musical instrument, a microprocessor-based MIDI controller designed by Leon Gruenbaum. A simple but powerful algorithm converts keystroke sequences from a standard computer keyboard into musical tones on an external synthesizer; the result is music never heard before with astonishing new harmonic contours. For information contact Leon Gruenbaum, 96 St Marks Place, NY NY 10009 Suite #2, phone (212) 475-5363 ext. 4. [9-4]

The International Symposium on Musical Acoustics takes place July 2 - 6 1995 at Dourdon, France (near Paris). Main themes will be new instruments & new sounds, and scientific research with application in instrument making. For information contact ISMA '95 Secrétariat c/o René Caussé, IRCAM, 1 Place Igor Stravinsky, 75004 Paris France. Authors are encouraged to submit abstracts; deadline Nov 1 1994. [9-4]

Two people are standing on the roof of a 20-storey building when one turns to the other and says "Let's jump off!" "Good idea!" says the other, so they jump. They accelerate rapidly as they fall past the 18th floor, the 15th floor, the 12th floor ... Around the time when they're whizzing past the 5th floor, one looks at the other and says "Well — so far so good!"

ANYONE CAN WHISTLE, known for its mail order catalog of unusual and beautiful instruments and sound toys, has opened a store in Kingston, New York, open 11 -7 daily. Call (914) 331-7728 for information or to request a catalog.[9-3]

BIOFEEDBACK SOFTWARE/HARDWARE: WaveAccess has released WaveRider, a MS Windows-based program with peripheral hardware that allows MIDI-compatable monitoring of biowaves. For information contact WaveAccess, PO Box 4667, Berkeley, CA 94704, (510)526-5881.[9-3]

Delta Spectrum Research has upgraded its HyperVibes software. Hypervibes is a collection of interactive HyperCard stacks containing research from both mainstream and non-mainstream physicists, with sections on music theory/physics among many other topics. Contact Delta Spectrum Research, 5608 S.107th E. Ave, Tulsa OK 74146; (918)250-5666.[9-3]

Newly released: **The Just Intonation Primer** by David B. Doty, a complete introductory text on the theory and practice of Just Intonation. Cost $7.50 plus postage & handling, or free with new membership to the Just Intonation Network. For information: The Just Intonation Network, 535 Stevenson St., San Francisco, CA 94013, Phone:(415)864-8123 FAX:(415)864-8726. [9-1]

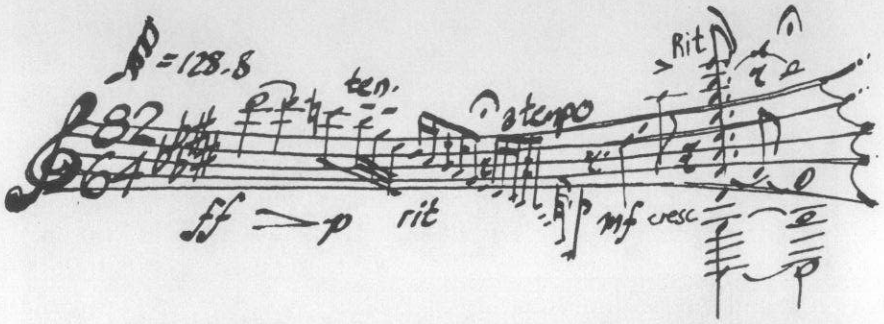
Sale! SCRATCH MY BACK; A PICTORIAL HISTORY OF THE MUSICAL SAW AND HOW TO PLAY IT, by Jim "Supersaw" Leonard. Prepaid U.S. $15 per book, includes mailing ($22.95) value. KALEIDOSCOPE PRESS, Janet E. Graebner, 28400 Pinto Drive, Conifer, CO. 80433-5309. [9-1]

A REMINDER -- Unclassified ads here in EMI's notices column are free to subscribers for up to 40 words; 40¢ per word thereafter. For others they are 40¢ per word, 15 word minimum, with a 20% discount on orders of four or more insertions of the same ad.

SUBSCRIPTIONS TO EMI: $24/yr for U.S.; $27/yr for Canada & Mexico; $34/yr overseas. California residents add 7.25% sales tax for a total of $25.74. Order from EMI, Box 784, Nicasio, CA 94946, USA.

EMI BACK ISSUES: Bound volume sets Vol I through Vol V: $17 per volume. Single issues Vol VI #1 through Vol VII #6: $3.50 per issue. Single issues Vol VII #1 and later: $6.00 per issue. These prices include postage for U.S., Canada & Mexico air, and overseas surface rate. For overseas air add 20%. In California add 7.25% sales tax. Order from EMI, PO Box 784, Nicasio, CA 94946, or write for complete listing of back issues and their contents. Corresponding cassette tapes also available for most volumes; see information below.

CASSETTE TAPES FROM EMI: $8 per cassette for subscribers; $10.50 for non-subscribers. Prices include postage for U.S., Canada, Mexico air, and overseas surface rate. In California add 7.25% sales tax. For overseas air add $20%. Each tape contains music of instruments that appeared in the newsletter during the corresponding volume year, comprising a full measure of odd, provocative, funny and beautiful music. Volumes II, III, VI, VII, and VIII remain available; volumes I, IV and V are now sold out. Order from EMI, Box 784, Nicasio, CA 94946.



Score by Mark J. Kelly

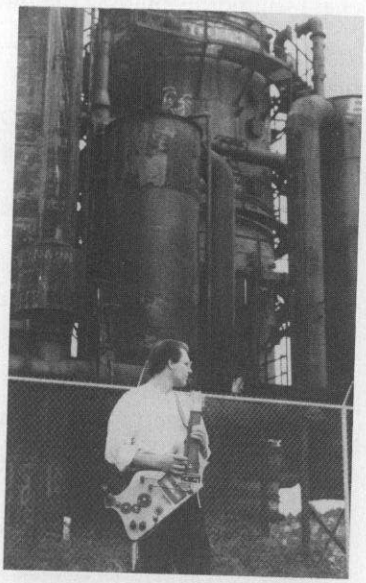
NOTES ON CUSTOM PICKUP WINDING AND THE QUEST FOR RESONANCE.

by Steve Ball

This is the first of two articles from Steve Ball on making electromagnetic pickups. (Electromagnetic pickups are the sort used on electric guitars; they can also be used in other applications where the initial vibrating body is of steel or other ferrous metal). This first article presents some general thoughts on pickup making for unconventional instruments, while the second, coming in EMI's next issue, will contain detailed instructions for making a simple home-buildable pickup.

Over the past three years I have entertained the idea of generating unique sounds from mechanical and electronic sources. Through the construction of several self-conceived musical instruments, I am realizing the importance of a few primary factors that contribute to the usefulness of an instrument. In this article, I will summarize a few observations on building unconventional electric stringed instruments.

Metal strapping removed from freight pallets produces an odd sound when a length of about five feet is allowed to extend from the hand, drooping until the opposite end touches the (concrete) ground. The result is an initial clang followed by a reverberant jangling that I wanted to adapt into an instrument. In designing an earlier metal strap instrument, the "Industrial-Strength Dulcimer" (fig.1), I had prevented the straps from producing the desired jangling by attaching both ends of each strap. Another feature that I did not consider in the design process was the ability of tuning the instrument to some common scale. Still, it remains an interesting percussive instrument. I have plans to produce an instrument that features a wide range of the desired jangling sounds by using various lengths of strapping, each with a free end to strike the ground.



Steve Ball plays the Elation Instiller

Following the desire to construct an instrument which can be tuned to a conventional scale, I designed and built the "Elation Instiller" (fig. 2). The frets were laid out using a ukulele template. This would have been effective in establishing a proper scale, but due to the bridge which is attached to a tremolo unit that does not return to its original position, tuning is lost. The twelve strings bend around dulcimer pins which are below the bridge. From here they extend about three inches, into some dulcimer hitch pins. If the strings are plucked in this area, the sound resembles the nut-plinking sounds of a guitar. However, with the manipulation of strings on the fretboard, the instrument takes on a sound of its own. A crank handle and gears pluck straps that intersect with the guitar strings over a pickup. This feature lacks resonance, due to the short, heavy gauge strap, and the abrupt plucking from the screws mounted in the last gear. If I were to replace these screws with tufts of wire bristles, a more interesting sound might be achieved.

Although I have learned some basics on the concept of mechanical sound generation, I have found that some of the

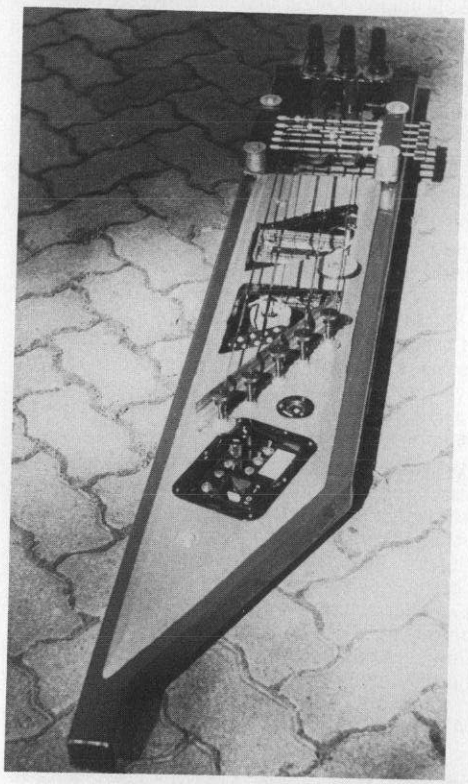
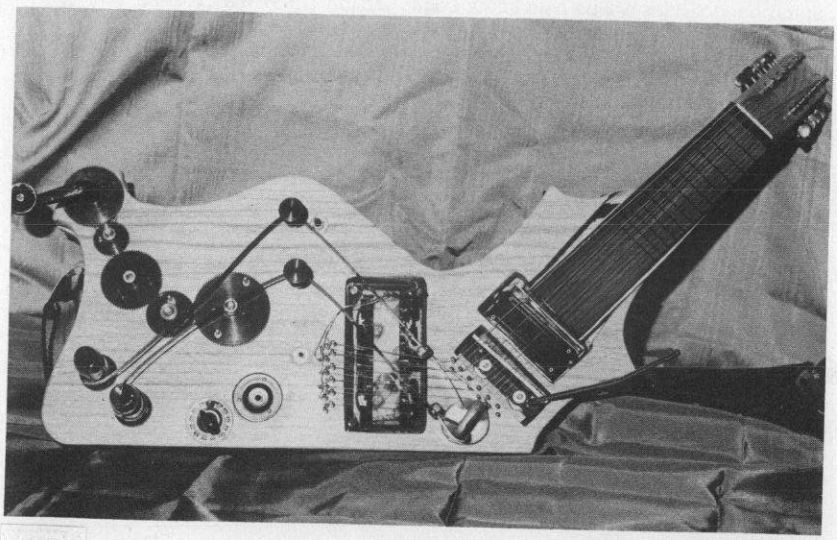


Figure 1 (left): ISD; Industrial-Strength Dulcimer

Figure 2 (right): Elation Instiller



subtle structural details of stringed instruments can transform into profoundly obvious contributors to the resultant sound. Through these experiences I have a heightened appreciation for the specialized research by many individuals that is documented in EMI.

I was inspired to construct custom pickups from the books *Guitar Electronics for Musicians*, by Donald Brosnac, and *Animal Magnetism for Musicians,* by Erno Zwaan. Both books were extremely helpful in explaining the many variables involved with pickup design. Much of this information could be found in textbooks or formal papers, explained to an exhaustive extent, but these books address the theory of electromagnetic induction as applied to the electric amplification of guitar strings. The basic idea here is that an electric current traveling through a coil creates a magnetic field which surrounds the coil. In electrical terms, this activity is called inductance. When a magnet, having its own magnetic inductance, is used in conjunction with a coil, as in the case of a guitar pickup, this activity is called electromagnetic inductance. The pickup is located on the instrument so that the invisible electromagnetic field that is created by the pickup is intersected by the strings. When a string vibrates, it causes a continuing voltage change, or "response", in the coil. When this response is fed to an amplifier, the result is an electrical interpretation, or "audio signal", which corresponds with the pitch and vibration of the string.

The pickups in the ISD were constructed around the double-coil "humbucking" concept, on a larger scale than a common guitar pickup. (In humbucking pickups, two coils are wired together in a specific way that reduces electromagnetic interference from outside sources.) Through this experience, I became familiar with three basic aspects of electromagnetic pickup design which effect the amplified sound: wire gauge, wire length, and the choice of pole element/permanent magnet. Winding your own coils can be fairly tedious, since pickups require a thin gauge of wire and many, many windings. The method I use is quite literally handwinding, whereas the industry term "hand-winding" implies a coil being wound on a machine, assisted by an operator. Alternatively, if the coil being wound is of a common size and dimension, you can have the coils wound by a professional manufacturer. I have also found many inductor coils which would be useful for a pickup application available where used electronic parts are sold. I evaluate them by connecting two test leads wired to a 1/4" audio plug, which plugs into a practice amplifier. Then I strike a tuning fork near the coil to hear the response (fig. 3). The coils in the ISD were of a very

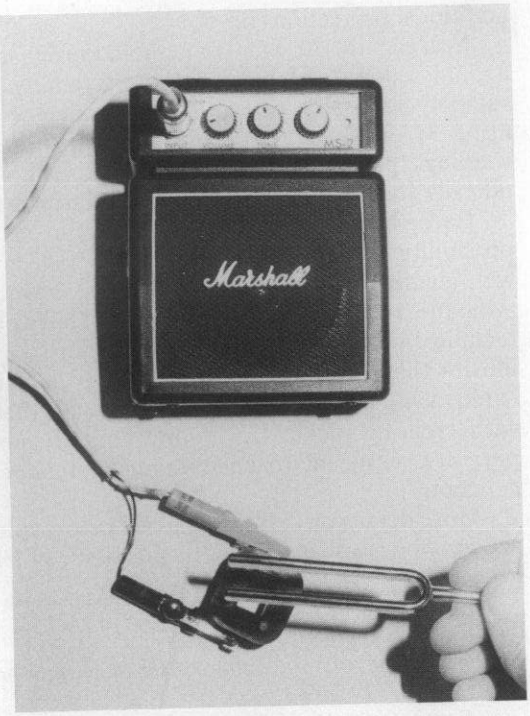


Figure 3: Tuning fork test of coil

odd size and dimension, and did not employ bobbins. They were wound directly onto the flat bar steel pole elements, which were shielded from the wire with plastic tape. Even though the magnet wire is enamel coated, a slight nick in this coating could create an unwanted electrical contact point between the pole element and the coil.

The pickups in the Elation Instiller were constructed using coils which were removed from telephone bell ringers. These were encapsulated in a plastic project box using two-part epoxy (fig. 4). Also contained in the box are several strategically-placed magnets, which increase the sensitivity of the pickup by augmenting the inductance of the coil. There are other ways to protect the coil from accidental scrapes which could easily sever the thin magnet wire, but encapsulation in epoxy produces an airtight seal and insures a "quiet" coil. I have pondered an environmentally-friendly encapsulating material, and have considered coating the coil with melted wax and encapsulating it in concrete or plaster. Many of the inductor coils that can be found in old electronic equipment are already protected by encapsulation, glue and tape, or other methods, and do not require

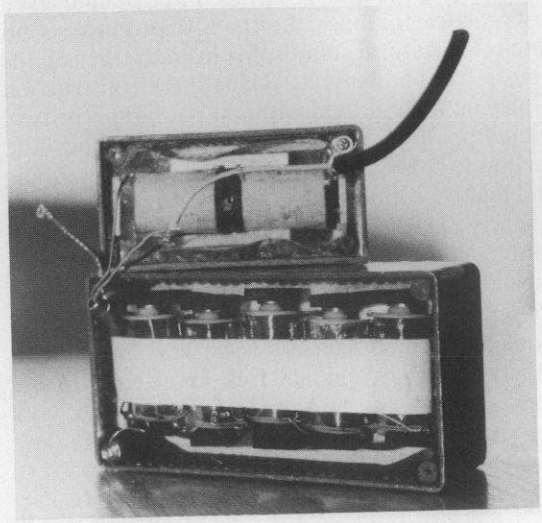


Figure 4 (left): Elation Instiller pickups.

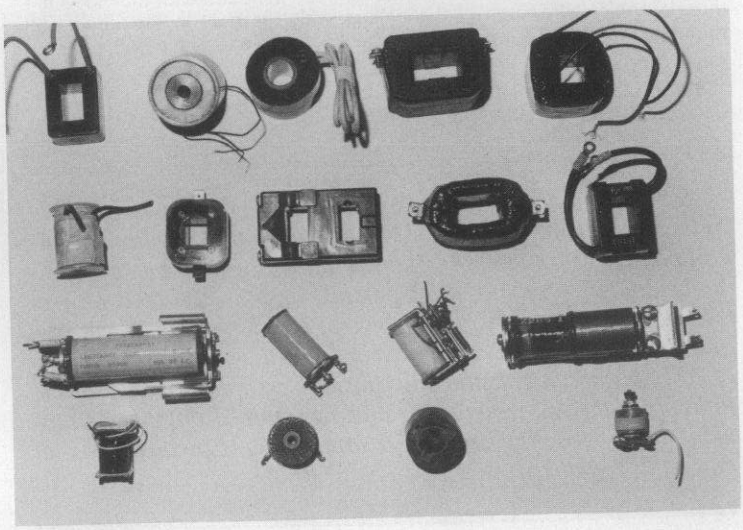


Figure 5 (right): Various inductor coils, removed from equipment. Top two rows are common air-core inductors, third row are relay coils, bottom row are smaller, various coils.

additional protection (fig. 5).

You can test the coils throughout the encapsulation process, and it is valuable to confirm their operability before the encapsulation material is poured. I have wound several pickup coils using 38 or 40 gauge magnet wire. In order to solidify the windings, prohibit loosening, and eliminate air spaces, I periodically coat the coil with nail polish during winding.

Each choice involved in pickup design has a broad range of possibilities. The main variables that I have noted (wire gauge, wire length, and pole element options), have an electronically symbiotic relationship to one another. I have purposely avoided technical details in this article, in order to avoid creating an illusion that success in designing your own pickups is a complicated task. The invariably satisfying results that I have achieved with creating pickups, with my limited knowledge and experience, is meant to encourage the reader to explore this concept.

More details on coil winding will be provided in a follow-up article which will appear in the next issue of EMI.

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Graf, Rudolf; **Radio Shack Dictionary of Electronics**, Howard W. Sams & Co. Inc., 1974

Lemme, Helmuth; "What Makes Pickups Tick?", **Electronic Musician**, December 1986

Zwaan, Erno; **Animal Magnetism for Musicians**, E Z Tech Publications, 1988 ISBN 90.9001858.1

OTHER REFERENCES

Antique Radio Classified, P.O. Box 2,Carlisle, MA. 01741; (508)371-0512. A good source of classified ads offering radios, coils, even RCA Theremins; free sample copy.

Lindsay Publications,P.O. Box 538,Bradley, IL. 60915; (815)935-5353. Has a large amount of useful electrical information, including **Build a Universal Coil Winding Machine**; catalog $1.00.

Steve Ball also has a videotape available, titled **Design and Construction of Electromagnetic Pickups for Musical Instruments**, which shows all construction details mentioned in this article. It is available for $10 postpaid, at the address shown below. The reason for its low price is attributed to its rustic appearance, which came from the use of consumer-grade equipment, and image breakdown occurring from the reproduction process. It was produced with the intention of being an informal presentation addressed to the special interests of those involved with experimental construction of musical instruments. Also included with the video are three technical drawings of the pickup which is built in the video. 58 minutes, VHS NTSC format. Make checks payable to Steve Ball.

Steve Ball
15600 NE 8th Street, Suite B1 #457
Bellevue WA 98008, USA

Steve Ball is an artist of sorts, who is able to demonstrate a wide variety of skills at substandard levels. This makes him a semi-proficient electronic technician, a luthier wanna-be, an anti-musician, an amateur draftsperson, and a freelance project manager. He has constructed several electronic musical instruments, most of which are featured in this article. His current areas of research are in constructing music-related electronic projects from old plans, harnessing the "jangling sound" from metal strapping, home recording and MIDI arrangements involving digital and analog synthesizers.

BOOKS

LA MUSIQUE VERTE: APPEAUX, SIFFLETS, CRÉCELLES ... (DEUXIÈME ÉDITION REVUE ET CORRIGÉE)

BY CHRISTINE ARMENGAUD.

Christine Bonneton, éditeur, 21, bd. du Maréchal-Fayolle, 43000 Le Puy, France, 1981.

Book review by Jason Gibbs

Christine Armengaud's *Musique verte* or "green music" is not limited to music created using instruments made out of plants, but rather is an exploration of sounds made using objects occurring in the nature. The book contains "over one hundred recipes for resonant playthings or musical instruments taken from the natural environment" (p.7). Armengaud describes her approach as that of an *école buissonière* or a field trip, using the environment as a laboratory where anyone can use their imagination to fashion instruments out of whatever is at hand.

She approaches the subject not as a musician, but as an elementary educator or folklorist. In researching this book she drew upon descriptions and histories of rural France and upon the memories of people who were children before the First World War. In preindustrial society people had everyday contact with the raw materials to make these instruments, many of which are noisemakers or toys used in children's games, or are used by hunters as calls to lure game.

The setting for her book is any region with farmland and forests, having marshes and beaches not too far away. While the resources the author uses are characteristic of the French countryside, it should be possible to adapt some of the "recipes" she provides to whatever a given environment has to offer. Most of the instruments are very simple, requiring little more equipment than a pocket knife. It would be fascinating to read books using this approach from a variety of cultures, climates or geographies. Green music from the desert will be different than green music from the tropics.

A remarkable range of material is used to make these simple and often ephemeral objects. Green music is as simple as blowing a blade of grass between two thumbs, or might require a little skill with a pocket knife. Examples of raw materials include certain flowers or petals that are inflated and then burst, carving whistles out of wood and bone, and fashioning simple stringed instruments from grasses, horsehair or animal guts. Some of the more unusual instruments are cages to trap crickets or flies and use the insects as the sound source.

The instruments described are usually not complex enough to allow for much nuance in the areas of pitch and dynamic level. They will be most practical for musicians trying to produce sound effects, or imitate other natural sounds, for instance the sounds of animals like birds, frogs and insects. Usually the construction and method of playing is described within a paragraph or two. There is little detail provided about the construction and little discussion about how to "play" the instruments except describing the kind of sound that is produced.

This is an attractive, rather whimsical little book filled with illustrations, children's rhymes, and folk tales. It demonstrates the beauty of a scale of musical exploration that is available to all regardless of proficiency or access to equipment. Armengaud at the end of the book tells of an organization she works with that is devoted to further exploring regional folk knowledge in her region of Provence-Alpes-Côte D'Azur in France. Her work should be an encouragement to those who want to explore their environment and its sound making possibilities.

RECORDINGS REVIEWS

By Sasha Bogdanowitsch, Warren Burt, Tom Nunn & René van Peer

HENRY DAGG : **MUSIC FROM THE CUTTING EDGE**

On cassette from Biscuit House-Music Division, 6 Sandhurst Rd., Belfast, Northern Ireland, BT71PW

Multi-instrumentalist and composer Henry Dagg brings us a charming tape of nine traditional tunes played on musical saw and piano, as well as compositions for bottle, glasses, etc. played via sampling, in his "Music for Special Effects."

Side A only features Henry Dagg's musical saw accompanied by his wife, Barbara, on piano. Most of all the compositions played are early 20th century pieces ranging from the classical, like Claude Debussy's "Clair de Lune" and Rakhmaninov's "Vocalise", to bright, show tunes, like V. Ellis' "Spread a Little Happiness" and J. McHugh's "On the Sunny Side of the Street."

The compositions and recording display the musical saw quite nicely, showing off the instrument's ability for long sustain, tremendous vibrato, and giant "gliss." However, the timbre, though beautiful and pure as can be, can be piercing, and I found it hard to listen for an extended length of time. It is difficult to describe its sound which is an odd mixture between a high, human like whistling and the abrasive sound of horse hair bowing metal.

On Side B, Dagg brings the listeners a humorous sampling frenzy of various sounds of wind, sea, sirens, train horns, glasses, bottles and phones in his "Music for Sound Effects." From the siren-sampled dance tune ,"Siren and Firin'" and the sampled struck and blown bottles of "Fruity Passions" to the spooky saw and autoharp tune "Dance of the Spirits" and the extensive sampled train horn and synthesizer composition, "Fanfare to the Boogie Man," Dagg's compositions are highlighted by a tremendous ear for the fun and eerie.

The two very different approaches traditional classical vs. the experimental sound effects contrast greatly. But they somehow are unified in that, apart from the synthesizer, Dagg uses only sounds that come from everyday household objects, not usually considered "musical" or sounded in the way that they are here.

—SB

ROBERT DICK AND STEVE GORN: **STEEL AND BAMBOO**

On CD from O.O. Discs, 502 Anton St., Bridgeport, CT, 06606-2121

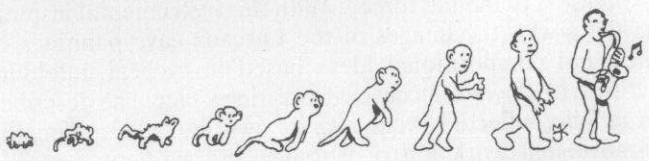
Steve Gorn and Robert Dick are two virtuoso flutists in their own right, the first a master *bansuri* (North Indian classical transverse bamboo flute) player and composer ,as well as a innovative pioneer in the new music/cross-cultural fusion music scene, and the latter an avant-garde new music silver flutist and composer, who is known for his fabulous discoveries and developments of extended techniques , like glissandi, percussive vocabulary, and "solo man" counterpoint playing, for the concert flute. This recording is a meeting of these two great artists, masters of their flutes from East and West.

Steel and Bamboo consists largely of duets between silver flute and bansuri, exploring a large gamut of playing and compositional styles. The jazz-influenced pieces, such as "Lapis Blues", "Tongue and Groove", and "Calaveras Jump", are quite interesting and compelling in the rhythmic and dynamic realms, but seem to rely on these two elements too much , not giving much space for the actual composition to shine through. On the other hand, the melodic outpourings and expressive qualities of other pieces hold substantial beauty, exploring the outer reaches and limitations of these various flutes. Among these lucidly melodic works are "Light", which features a bass *bansuri* and silver flute, "Piece in Gamelan Style", a solo which features Dick's multiphonic and solo counterpoint playing, and "Seven Cranes", a solo by Gorn in the strange intonation of the Japanese gagaku bamboo flute, the ryuteki.

The "tour de force" however is the three movement work, *Sea of Holes*. The first movement , "Calling, Sending, and Waiting", opens with Dick's brilliant, wave-like explosion of overdubbed silver F bass flutes frolicking in their percussive clicking and tonguing. The second movement , "Ubud," is named after a Balinese village famous for its end blown flute, the *suling,* and delights with the playing of three ethnic diverse flutes ,one after the other. It features Gorn's beautiful melodic playing of the Amazonas flute, the North American Indian Lakota cedar flute, and the Balinese *gambuh* flute, over Dick's brilliant bass flute whistle tones. The third movement closes with the Dick's F bass flute featured again, but this time using circular breathing and harmonic tones under Gorn's distant playing of multiple Indian penny whistles.

Together Robert Dick and Steve Gorn create an album that reaches beyond the categories of the traditional aesthetic views of the silver flute in Western art music and the extremely rigid improvisational performances of the North Indian classical *bansuri*. Ultimately it succeeds in making a music that is both new, interesting and worthy of listening by flute lovers, improvisers, new music and world music enthusiasts alike.

—SB



FAST FORWARD: **PANHANDLING**

On CD from Lovely Music Ltd, 105 Hudson Street, New York, NY 10013 (LCD 2091)

There is a definite sense of magnetism surrounding metal when struck. There's ring and hum, drones, buzzing, chiming and pealing; wide and deep, or hellishly shrill and there's lots of steps in between. Fast Forward regularly immerses himself in all varieties of these timbres. His basic instrument is the steel drum or pan, but he may use any percussion instrument; for the rhythm, and for the reverb. He often makes waves of vibrant sound stand like solid in a space. The dynamic range of what he plays stretches from a Jew's harp to copper pipes strewn from a jute bag on a tile floor and fooled around with (the latter not on the CD). On two tracks FF has a ball rolling around over the concave surface of the pan, once after filling it with water. He has a piece for a coil of flat metal, a bathtub and three temple bells. The means are relatively simple, but chosen with a playful and imaginative mind. The result is rich and surprisingly delicate, given the generally high level of the sound. Over the throbbing and bouncy rhythms he unfolds engaging melodies

that leave an acoustic afterglow – it hovers like a shimmering veil over the music, suggesting the mesmerizing appearance of the northern lights. In metals there is a certain aspect of coolness, ionization, charge, leaping around levels of energy. It enables Fast Forward's music of metal to suck you in. By the ears.

—RvP

ANNEA LOCKWOOD: **THOUSAND YEAR DREAMING**

On CD from 'What Next?' Recordings, c/o Nonsequitur, PO Box 2638, Santa Fe, NM 87504

Native to New Zealand, Annea Lockwood studied instrumental composition and electronic music in England, Germany and Holland, before settling in the U.S., where she now teaches composition and electronic music at Vassar College in upstate New York. Annea has been known for her explorations into the rich and spontaneous world of natural acoustic sounds, in pieces such as *Glass Concert* and *Piano Transplants*, as well as her compositions for the recorded sound of rivers and other environments in works such as *A Sound Map of the Hudson River* and *World Rhythms*.

Annea returns to her instrumental writing in her new work, *Thousand Year Dreaming*, picking an enormous assortment of instruments that help her convey her sensual explorations into the natural world. Instruments included are: *didjeridus*, conch shells, clarinet, oboe, trombone, *waterphone*, stones, frame drums and tam-tams, played by such artists as Jon Gibson, Scott Robinson, John Synde, Art Baron, and Libby Van Cleve.

Little pictures these pages by Mark J. Kelly

Lockwood is yet another composer of the present who has been seduced by the powerful sound of the Australian didjeridu. She describes it as "the sound of the earth's core pulsing serenely, an expression of the life force." With this instrumental inspiration, along with the images of the Lascaux cave paintings of France and compositional ideas based in cyclical unfolding structures, Lockwood succeeds in creating a piece she describes as "a mobile, inflected event with its own life." It is a lengthy four-movement work full of vibrancy and subtlety, certainly awakening and releasing the power of this sonic energy that she talks of.

In the first movement, "Breathing and Dreaming," conch shells fill the air with their beating tones, followed by extremely slow expositions on the clarinet, trombone, english horn, and didjeridu respectively. With the bright clash of clap sticks, the mood begins to change in "The Chi Stirs". Here the introduction of the waterphone and gong superball harmonics leads to the giant crescendo swells in the clarinet and trombone, which seemingly try to get at something, but never really get there. In the third movement, this suspension is resolved somewhat in "Floating in Mid Air," where the woodwinds and brass converse, uniting in a liquid-like, drowsy rendition of a sick harmonic series.

Finally in the last movement "In Full Bloom," a deluge of flurrying frame drums are added, which a quartet of didjeridus overcomes. This texture retreats once more into silence before finally emerging again with the whole ensemble, accelerating in speed and volume to a most raucous and satisfying climax that suddenly brings the piece to an abrupt closing.

—SB

BARTON AND PRISCILLA MCLEAN: **RAINFOREST IMAGES**

On CD (CPS-8617 CD) from Capstone Records, 252 DeKalb Avenue, Brooklyn, NY, 11205 USA. Available from Albany Music Distributors, PO Box 5011, Albany NY 12205, USA; 1-800-752-1951.

Barton and Priscilla McLean are two composers whose dedication to nature and ecological causes have guided their work. Over a number of years, they have visited rainforest environments throughout the world, recording sounds and organizing them into pieces which they hope will raise people's awareness of the need to preserve these delicate places. Since 1989 they have been touring the world with their installation "Rainforest," which consists of playback of tapes of rainforest and other sounds, along with invited improvisation from members of the public. By 1990, they had collected a number of tapes of this installation and created, with assistance from the composer/electronic technician Panaiotis, the lush 48 minute montage presented here.

To say that "Rainforest Images" is romantic is an understatement. The McLeans are consciously developing a very interesting late-20th century hyper-romantic aesthetic. Their dedication to capital *N* Nature is of a piece with their Transcendentalist philosophy, which unashamedly acknowledges its heritage of ideas from Thoreau, Muir and, musically, Charles Ives. Their rich multi-layered mixes, already charged with highly evocative bird and other animal calls, are made even richer with their accompaniments, mostly consisting of long notes, sustained chords, and ornamental flurries of electronic bell and harp sounds; and also by Panaiotis' digital processing and equalizing. Improvisations by three Australian musicians, on didjeridu and voices, also add to the overall richness of sound.

For me, one of the fascinating things about this piece is how all the types of sound used electronic sound; acoustic instruments, straight, extended, and sampled; voices, straight and modified; animal sounds; and digital processings of all of these merge into one sort of "superorchestra." Nothing loses its identity, but everything seems integrated into a kind of all-embracing sound world.

Readers of EMI will be particularly interested in Bart McLean's clariflute (clarinet mouthpiece, recorder body) improvisations that start section 3 of the piece, which remind me of whalesong (Whales in the rainforest? The metaphor is getting pretty broad here!); and in Panaiotis' impressive digital modifications with his "Extended Instrument System."

One issue the piece raises is that of exoticism. For most people, the amazing sound of the Australian magpie, a recurring motive in the piece, will probably be incredibly exotic. For Australians, though, this extremely common sound will simply raise a familiar smile. Who is exotic to whom?

Interesting comparisons can also be made as to how different composers use similar material. The Australian composer Ron Nagorcka's work for sampled Australian bird calls, didjeridu and other acoustic instruments, and political environmental poetry, for example, is much leaner, and angrier, than the McLeans' luscious, almost sweet sound mix; while English composer Trevor Wishart's use of animal sounds in his 1977 "Red-bird" was for much darker and more sinister purposes. By contrast, the McLeans' approach is optimistic and reverential, "a myriad of voices raised in song to the beauty of the rainforest," as they themselves describe it.

Also on the CD are two solo works, both on related themes. Priscilla McLean's "On Wings of Song" is a hilarious hommage to the mosquito; while Barton McLean's "Himalayan Fantasy" takes a recording of a Tibetan folksong and weaves an impres-

sive electronic tapestry around it.

—WB

NEWBAND: **MICROTONAL WORKS BY PARTCH, CAGE, LABARBARA, AND DRUMMOND**

On CD from Mode, P.O. Box 375, Kew Gardens, NY, 11415

Founded in 1977 by New York microtonal composer/musician Dean Drummond and his flutist wife, Stefani Starin, Newband is one of the few contemporary music groups that innovatively challenge the borders of music of our time. In so doing, they have crossed the whole 20th century gamut of musics, from atonal, tonal and microtonal music, to jazz, rock, and minimalism too, all on extended traditional and new and unusual instruments.

This recording of microtonal works by contemporary composers focuses on the marvelous instrument , the *zoomoozophone*. Dean Drummond built the instrument in 1978 after studying and playing with composer, instrument builder, and intonational theorist Harry Partch. It is a percussion instrument of 129 aluminum tubes tuned to a 31-tone scale all in just intonation. It is arranged chromatically on four stands and allows playing by one to four players. *Zoomoozophone* comes from the word *zoom*, as in the shift of focus from close to far; *mooz* is zoom spelled backwards, reflecting the symmetry of the just tuning; and *phone* of course means "sound."

Opening with Partch's "Two Studies on Ancient Greek Scales" which was originally intended for his *Harmonic Canon* and *Bass Marimba*, Newband executes this fine, pretty, oriental-influenced early work in the shimmering modes of Olympus, whose just tunings are 1/1, 9/8, 6/5, 3/2, 8/5,& 2/1, and the Greek enharmonic scale 1/1, 28/27, 16/15, 4/3,3/2,14/9, 8/5, & 2/1.

The other pieces on the disc, though finely constructed and superb in their displays of the versatility of the *zoomoozophone*, do not seem to hold together well with their forays into 20th century dissonance, atonal melodies, and drastic register changes.

Dean Drummond's two works, "Then and Never" and "Columbus" show similar patterns, but also offer a great world of timbral and compositional possibilities, ranging from the sporadic, endless ringing of the *zoomoozophone* to the serpentine wiggling and squirming of the flute, to the more precise rhythmic and subtle shifts of modes and tone clusters between the two instruments. His third work, "Incredible Time" is widely different in incorporating the digital media with the Yamaha DX7II synth and Korg DDD 1 digital drums along with various Chinese gongs and cymbals. It largely deals with contrasting textures and timbral changes in the synth and modulation between the different scales in the microtonal tunings.

John Cage's "Haiku for flute and zoomoozophone" is typical of his detached "Zen" pieces; very quiet and full of much space. Joan La Barbara's "Silent Scroll" explores "articulated clusters", glissandi, and the acoustic phenomenon beats. However strange or familiar these sounds may be, Newband surely fills a giant gap in giving due respect to alternate tuning systems and new and unusual instruments.

—SB

The Official Project: **OFFICIAL WAFER FACE RECORD**

On vinyl from Wafer Face, Box 4272, Station A, Portland, ME 04101

... so, I put on the wafer face record and went outside tENTATIVELY A cONVENIENCE compelled This Action hearing assorted Cue Activated Modular Units, Chris Astier and I impulsively said, "It's sick, man!" Thirty seconds of total silence... sandwiched between loaves of chaos. John Eaton, Scott Larson, John Berndt, Peter Williams, and I scratched our heads. Babydoll Courtney McCullough squeaking, synthesizered Sarmad Brody moans, sliding Eric Myers Slinky Reverbed Cello whistles should I come back in? Neil Feather and Jake T. Unclean said NOT!! So I read the accompanying 26-page booklet to Eric Myers and John Dierker understood the "generally unusual restrictions on playing wch are meant to discipline the player, focus the player's attention, unify the group's playing in some self-conscious way, & stimulate ways of playing that the player might not be ordinarily inclined to." "And what will it be tonight?" I asked, and Dawn Culbertson said, "I like 'the Official, April 29th, 1992EV, Band that Does Accept Money from Institutions' – they know what's up...," what's out[SIDE A], I thought, "is an excerpt from the 15 member core group of the 1st 2 months of practices that led up to the D.A.T." [A]based on a parade of sounds deconstructed to the max, silliness and humor in a conducted play of Walt Novash/Steve Berson sonic imagery, WCH, indicative of "the Official Krononautic Protectors of Media Executives & Their Families Orgestra," found Clark Snell and Jimmy Hedges headed out barefooted. Given "Earth shoes, a history of insanity of the family, migraines and drowning are all factors that can influence the subjective interpretation of pitch," (from the 23rd Page, "The Subjective Nature of Pitch" by John Berndt), where was I to turn [?] around and head back to the other [SIDE] B yond the parade of slide whistles, funky sax, yells upon metallic percussion, over oom paa paa drums and brass. My head swam, baby!

—TN

[From the editor: The preceding is reviewer Tom Nunn's response to the recently-released vinyl lp from Wafer Face, containing the work of a group of sound art people centered predominantly in Baltimore. The record comes accompanied by a magazine-sized booklet introducing the performers and giving information on compositional methods and performance techniques, as well as providing some sense of the philosophical, social and musical milieu from which the music arises. Aside from the production's aesthetic impact (from which Tom is still recovering), the record and booklet stand as important documents of what has in recent years been an esoteric yet extraordinarily fertile scene.]

ZEENA PARKINS: **NIGHTMARE ALLEY**

On CD from Table of the Elements, P.O. Box 423838, San Francisco, CA 94142

Zeena Parkins is a veteran of the new music scene, and her recent CD proves to be a showcase of timbral possibilities of the harp that goes well beyond expectation. But then, this is not just any harp! We hear a remarkable musician playing a remarkable instrument. I'd say it's actually a "magic harp," one capable of the most diverse landscapes of sound and style. The many different musical characters are very much linked to the way the harp is used and processed. Not one piece is without strong character, each easily distinguishable from the others.

(Experimental music can sometimes begin to sound a lot alike within one album featuring one instrument. Not the case here!)

It is difficult to imagine just how Ms. Parkins gets these sounds from a harp. Of course, some pieces do present the harp as we normally think it sounds. However, such moments are nestled within the context of a sophisticated new music language of multiple simultaneous styles. One such instance is an accompaniment of classical harmonic/romantic arpeggios that is viciously attacked by another "voice," digitally processed and

percussive, making an effective juxtaposition of past and present.

There are moments when it is apparent that objects are placed on the strings, creating buzzings and thumpings. (A photograph on the inside cover shows a long bolt somehow attached to the strings.) And this amazing harp has an ability to bend pitches way beyond what a normal harp can do, and without the characteristic rattle/buzz that so often happens. Then there is the digital processing, used quite effectively to extend the sonic range of this already incredible instrument.

Ultimately, though, as interesting as the instrument and sounds are, it's the mature musicianship that stands out, with a virtuosic technique as well as a composer's sensitivity to issues of form and structure..., and all this with an attitude!

I'd highly recommend this CD to EMI readers as an example of a simple principle the plucked open string taken to the extreme edge of its possibilities, within a strong and imaginative experimental/improvisatory expression.

The Table of the Elements label, based in San Francisco, is in the process of releasing other new music recordings. If this one is typical, we're in store for some great new music CDs!

—TN

ELLEN N. SCHULTZE : **TRIPLE OCTAVE SHAKER CHIMES**

On cassette from Ellen N. Schultze, 1516 42nd St., Sacramento, CA 95819

This tape by Ellen N. Schultze displays the Triple Octave Shaker Chimes, which are a version of the Deagan Organ Chimes described in EMI Vol. IX #2. Ellen Schultze's set was made in 1898, in Chicago, IL, for use in the traveling tent show *Chautaqua*. These metal chimes bear a very close resemblance to the Indonesian bamboo rattle, the angklung, and produce brilliant, rich tones due to their air-resonated metal tubes and the technique of rapid chimings on one note to produce the sound.

After first hearing the instrument played by Reverend and Mrs. Alley of Oregon in 1928, it was not until 1971 that Ellen actually bought the set. Historically the instrument was most often used to play Christian hymns and British and American popular songs, and she does just that, playing the traditional hymns, "In the Garden", "Amazing Grace", and "How Great Thou Art," and the popular songs "Memories" and "Out Where the West Begins."

A featured bonus in this recording is Ellen's use of her limestone slabs (a set of suspended ringing stones) in the piece, "Rock of Ages" and the shimmering four-in-hand bells and piccolo bells in the works "Believe Me If All Those Endearing Young Charms" and "Cruising Down the River," which she plays with techniques similar to the shaker chimes.

It may be termed a low-fidelity recording, but the tape captures the quality of the instrument quite nicely. Though it would be wonderful to hear the instrument in other contexts (maybe Balinese gamelan?), the tape captures perfectly the time and place from which the instrument arose.

—SB

JOHN SCHNEIDER AND AMY SHULMAN : **JUST WEST COAST**

On CD from Bridge Records, Inc., Box 1864, NY, NY 10116

Just intonation guitarist John Schneider and concert and celtic harpist Amy Shulman play just intonation works by four Californian composers, Harry Partch, John Cage, Lou Harrison, and LaMonte Young, on this remarkable recording.

The instruments used are the Just Guitar, a recreated replica of Partch's Adapted Guitar, and traditional Celtic and Concert Harps. The need for tuning the guitar's six strings individually was accomplished by German luthier, Walter Vogt, in his creation of the Fine-Tuneable Precision Fret-Board. The recreation of Harry Partch's Adapted Guitar of 1934, which was a pre-World War II C.I. Martin guitar, required unusual frets and stringing as well. The strings are grouped in three octave pairs tuned in pure thirds, and the placement of the frets is determined by his system of 43 tones per octave. The traditional Celtic harp is used along with the usual concert harp to provide an extra brilliance in the tuning of pure intervals due to its metal strings, opposed to the concert harp's gut strings.

These instruments provide a dazzling vehicle for the compositions that follow. Partch's famous highway hobo piece *Barstow* comes to life in brilliant clarity, sacrificing only the 1968 original recording's rustic and raw quality. Also Partch's "Two Studies on Ancient Greek Scales", composed originally for his Harmonic Canon, takes on new dimensions with the celtic harp and guitar arrangement sharing the melody and chords.

Lou Harrison's works are represented by his *Suite No.2* and *Six Sonatas*. Originally for harp in just intonation, *Suite No.2* is rendered splendidly, from the opening "Jahla", combining medieval European musical forms with North Indian *jahla*, through the beautiful "Beverly's Troubador Piece" and "Waltz for Evelyn Hinrichsen," to the "Sonata in Ishartum," uniting 18th century A.D. European binary forms with an 18th century B.C. Babylonian mode. Likewise, Harrison's 1943 work, *Six Sonatas*, originally intended for plucking string keyboards, like the harpsichord, is played quite nicely in this never-before-recorded work.

Though not completely characteristic of their main writing styles, works of John Cage and LaMonte Young are featured too. Cage's 1948 composition, *Dream*, for guitar and harp, and *In a Landscape*, for solo harp, are Satie-influenced works inspired by the rhythmic structure of dance. Young's 1959 *Sarabande* is a piano exercise that has been retuned to a complex chromatic tuning.

Tied together by their inspiration from the East and their extensive use of alternative tunings, these composers' pieces are well suited for this kind of disc. Along with Schneider's complete notes on the composers, their work, the tunings and instruments, this disc is worthy of enormous attention, not simply for the music and fine performances, but for the fact that it pays homage to four very influential American composers and honors the very special tunings of just intonation through the vehicle of these beautiful instruments.

—SB

Recordings for review may be sent to EMI at PO Box 784, Nicasio CA 94946 USA, or directly to our regular reviewers: Sasha Bogdanowitsch, 460 Canal St. #9, San Rafael CA 94901; Tom Nunn, 3016 25th St., San Francisco CA 94110; or René van Peer, Bachlaan 786, 5011 BS, Tilburg, Holland.

EMI's regular reviewer René van Peer has less than his usual share of reviews in this issue because he has been busy with other things. Congratulations to René, Zsuzsa and their brand new little one, Esther Helena.

Here is another installment in **Experimental Musical Instruments'** *sporadic reprints series, featuring articles about unusual instruments gleaned from early periodicals. Our thanks (not for the first time) go to Don Dries, who brought the articles to EMI's attention and provided the originals.*

"Dream of a Salesman" and "A Piano for Invalids" first appeared in early issues of **The Etude**. **The Etude,** now defunct, was published from 1883 to 1957 by Theodore Presser Company. No author or photo credits were given.

A PIANO FOR INVALIDS

An English inventor has devised this unique piano, in order to permit those who are bedridden to enjoy their favorite instrument.

DREAM OF A SALESMAN...

John Alpin Graydon, 72-year-old retired sales executive, has invented a unique violin bow. Actually it is four bows fastened at the ends. Finger stops on the bow make it possible to play one, two, three or all four strings at the same time for chords. The unusual fingerboard is tilted at an angle of 45 degrees. Mr. Graydon is a graduate of Fordham University and Stevens Institute of Technology. Since his retirement he experiments with gadgets in his home-laboratory, Ridgefield, New Jersey.

RECENT ARTICLES, continued from back cover

electronic instruments, and describes two "gesture instruments:" The Sonar System, in which the player's physical position relative to a sensor controls the sound output, and the Dada Glove, in which hand movements reminiscent of sign language control the output.

"Creating a Visual Translation of Kurt Schwitters's *Ursonate*," by Jack Ox, discusses a painter's approach to interpreting musical sound as visual imagery.

As always with the **Leonardo Music Journal**, a CD accompanies the print journal. This issue's CD is devoted to vocalization and explorations of phonetics. Among the pieces is *Long Tube Trio* by Brenda Hutchinson, in which the composer/performer explores the acoustics of a 10-foot tube through vocalization.

Among the articles in **Woodwind Quarterly** #4, Feb 1994 (1513 Old CC Rd., Colville WA 99114):

"Landell Flute Tune-up Part II", by Jonathan A. Landell, continues the author's step-by-step procedure for regulating flutes.

"Designing the Scale of the Boehm Flute", by John Coltman, gives highly accurate procedures for locating and sizing toneholes on Boehm flutes, as well as illuminating the reasoning behind the procedures. Bore shape and cork location are considered as well.

"Authenticity", by Kanji & Sorel, discusses practical and philosophical facets of making early instrument reproductions with special reference to recorders.

Among the articles in **Utandande** 4, March 1994 (1711 East Spruce St., Seattle WA 98122-5728):

"Traditional Musical Instrument Makers Found in Zimbabwe," by Tendai Ziyambe, covers the topic described in the title, with special insight into practical and economic factors affecting the work of contemporary African makers.

"Miking and Recording Shona Instruments: A Discussion," features three short pieces by separate authors on miking or the use of pickups for recording or live performance.

There are also short articles on marimba and mbira making from Steven Smith (wood selection for marimbas), Scott Baker (making a simple mbira), and Robert Twohawks (overtone tuning for marimba bars and adding resonator tubes).

The following is a listing of selected articles relating to musical instruments which have appeared recently in other publications.

"P.W. Schreck: Father of Calamitonality", interview with P.W. Schreck by Annie Gosfield in **The Improvisor** Volume X 1993 (1705 12th St. So., Birmingham AL 35205).

P.W. Schreck is, or was in earlier days, a pianist who also worked with microtonal mixed-junk electroacoustic sounds. He has a strong and cynical sense of humor, a sharp tongue, and low tolerance for anything he regards as pompous nonsense. You can get some sense of these things, and learn a little of his colorful and checkered history, from this interview.

"Two Sound Performances and a Few More Raccoons" by Jed Speare, in **P-Form** 31, Spring 1994 (756 N. Milwaukee Ave., Chicago IL 60622).

A review of a 1993 program by Ean White of Mobius Artist Group. White draws from an interesting range of sound sources including a live short-wave radio (which doubles as a crude theremin), pre-recorded cassette tape, delay and gating effects.

"Dangerous Rhythms" by Robert Neuwirth, in **Option** #54 Jan-Feb 1994 (1522-B Cloverfield Blvd., Santa Monica CA 90404).

An article on sound artists whose performance work involves dangerous spectacles. Among them: Barry Schwartz (using metal-tipped insulated gloves to create an outrageous electrical display by strumming long, highly charged wires in a watery environment); D.A. Therrien (who wears charged metal plates padded with insulators over his naked body, to be played, with dramatic arcing, by another performer with electrified drum sticks); Chico MacMurtrie (who makes large-scale mechano-anthropomorphic robots to play drums and other sound sources); Matt Heckert (who makes big, visually and musically dramatic mechanical orchestras); Scott Jenerik (who drums on flaming steel with contact-mic-tipped gloves); and Timothy North (who performs suspended in mid-air within a cage constructed of percussible objects which is rickety and appears ready to break up and fall).

"Seanchaidh, a Playable Sculpture" by Esmé Boone, in **Folk Harp Journal** #82, Winter 1993 (4718 Maychelle Dr., Anaheim, CA 92807-3040).

A description of the making of a simple harp from salvaged materials by a novice maker, with an emphasis on the magical qualities of the experience.

"Meaphones Lost!" in **Middle Horn Leader** (PO Box 8402, Paducah KY 42002-8402).

A very brief report on the disappearance of a set of unique hybridized brass instruments produced by Ziggy Kanstul. They disappeared in transit via United Parcel Service.

"Part One: Oil Finishes" in Sam Rizetta's regular *Technical Dulcimer* column in **Dulcimer Player News** Vol. 20 #1, Jan - March 1994 (PO Box 2164, Winchester VA 22604).

Notes on wood finishing for stringed instruments.

"Mountain Dulcimer Tales & Traditions" by Ralph Lee Smith, also in **Dulcimer Player News** Vol 20 #1 (address above).

A report on a unique early American instrument described as "a scheitholt [German lap zither] mounted on a soundbox," thought to shed some light on the early development of the Appalachian mountain dulcimer.

"A Portable Glass Organ and a Glass Armonica", excerpted from **E. Power Biggs: A Concert Organist** by Barbara Owen, in **Glass Music World** Vol. 8 # 1, Jan 1994 (2503 Logan Dr., Loveland CO 80538).

Part two of an excerpt describing the making of a glass armonica at the Corning glassworks for the well-known organist.

Musicworks 58, Spring 1994 (179 Richmond St. West, Toronto, Ontario, Canada M5V 1V3) has reminiscences of John Cage from several people who worked with or were touched by him during his lifetime.

Music Trades Feb 1994 (PO Box 432, Englewood NJ 07631) has several articles on recent developments in electric guitar and bass guitar manufacturing.

"Totally Dynamic Tuning Using MIDI Pitchbend" by Jules Siegel, in **1/1** Vol 8 #2, Jan 1994 (535 Stevenson St., San Francisco CA 93103).

Notes on using the MIDI pitchbend feature for playing MIDI instruments in non-standard tunings.

"The Enhanced Piano" by Loren Rush, Janis Mattox and Alfred Owens, also in **1/1** Vol 8 #2 (address above).

A description of a justly tuned acoustic piano with additional electronic processing of the sound.

Among the articles in **American Lutherie** #36, Winter 1993 (8222 South Park Ave, Tacoma WA 98408):

"Principles of Guitar Dynamics and Design," by Ervin Somogyi, is a transcription of a lecture addressing various topics of practical concern to makers of guitars.

"What You Should Know About the Hardanger Fiddle," by David Golber, contains descriptive details about the violin-like Norwegian instrument.

"Historical Lute Construction: The Erlangen Lectures, Practicum, Part 12," by Robert Lundberg, continues this excellent series on lute making.

"Prepare to Meet the Maker: Scot Tremblay," by Jonathan Peterson, is an interview with a maker who specializes in reproductions of the shapely, smaller guitars of the 19th century.

In the *Product Reviews* column by Harry Fleishman, a report on a clever guitar tuning machine mechanism which allows retuning an individual string on the fly to a pre-set pitch.

Among the articles in **Leonardo Music Journal** Vol 3 1993 (MIT Press Journals, 55 Hayward St., Cambridge, MA 02142-9902):

"Skyharp: An Interactive Electroacoustic Instrument," by Kristi A. Allik and Robert C.F. Mulder, describes "a 'virtual instrument' designed to collect visual and audio information from natural dynamic systems found in selected outdoor environments." The basic components are a video camera, an audio spectrum analyzer, an ambient light detector, a computer for manipulating the data, and a sound playback system which plays a computer-generated composition, all in real time in the original environment.

"To Listen and See: Making and Using Electronic Instruments", by Xavier Chabot, discusses the relationship between gesture (performer's playing movement) and resulting sound in

(Continued on page 43)